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A STUDY OF THE CRANIA OF THE HYLAM CHINESE.

BY GORDON HARROWER, M.B., CH.B., D.SC., F.R.S.E., Professor of Anatomy, King Edward VII College of Medicine, Singapore.

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1. *Introductory.* In my previous paper on the Hokien and Tamil skulls I ventured to state that the Hylam* skull showed marked variation from the Cantonese skull which resembles the Hokien skull very closely. In a criticism of my paper which appeared in a recent number of *Biometrika*† Dr Morant went to some considerable trouble to show that I was probably wrong in my statement. However, the difference in shape of the Hylam head is so obvious, as to be appreciated even by the uneducated coolie class in this part of the world. The object of the present paper is to indicate in which characters the divergence is most apparent and to compare the Hylam with other Asiatic series.

* The more correct spelling of the word is probably Hailam but the local spelling is usually Hylam, the form I have used throughout. It is not an easy matter to transliterate a foreign sound into Roman characters, especially when the character represented by the sound has a slight difference of intonation when used by different sections of a community.

† "The Use of Biometric Methods applied to Craniometry." *Biometrika*, Vol. XVIII. pp. 414 *et seq.* [Dr Morant was not so much questioning the difference between the Hokien and Hylam skulls, as emphasising the astonishing degree of likeness between *Chinese* crania from very different parts of China. See the citation he makes from Prof. Harrower's paper, p. 415, and the Table he provides on p. 416 of *Biometrika*, Vol. XVIII. According to Prof. Harrower, the C.R.L. of Hokien and Hylam crania is 18·43 for all characters, but that of Hylam and Serbo-Croat is 17·14, or the Hylams are slightly closer to a European race than to the Chinese. My Chinese friends do not admit the Hylam folk to be Chinese, although they occupy *Chinese* territory.—ED.]

The material for my paper consists of 39 Hylam male crania obtained in Singapore. As I pointed out in my Hokien paper, had these skulls been obtained from individuals born in Singapore they would be atypical, as the pure Hylam female is rarely found outside the native island of Hainan. I have not been able to procure a single example of a female Hylam skull. The skulls were taken from unclaimed Hylam bodies shortly after death and each was provided with a numbered metal disc so that no error could arise during the preparation of the skull. I have to tender my thanks to Dr G. A. Finlayson, lately Pathologist at Singapore, for permission to collect the material. The age of each individual was noted, so that there can be no doubt as regards sex and age. There is a very large immigrant male Hylam population in Singapore. They are employed chiefly as house servants, the wages here being very much larger than can be obtained elsewhere in the East.

2. *Measurements and Methods of Measurement.* One disadvantage of working in the outposts of the Empire is the difficulty of obtaining access to a reliable reference library. For comparative material I am therefore dependent on a few papers personally collected at various times. I believe that craniometrical work to be of value must follow some accepted scheme as far as possible. Accordingly I have followed the methods of the so-called empirical school and also the methods of the Biometric Laboratory as far as possible, without, however, taking duplicate measurements of practically the same character, e.g. total height. In my case, where the work must be done in the time which can be snatched from the teaching of systematic and practical anatomy and embryology without any qualified assistance, up to the standard required by the British Medical Association for recognition of the qualification to practise in Britain, time limits the measurements to the most necessary. For example the orbital width by the geodesic method is omitted. The dacryon is at least a definite point from which to measure and for comparative purposes, it matters not whether the measurement is the absolute maximum possible, as after all, it is the degree of divergence which is being compared. Again the nasal height is measured in the Biometric Laboratory from nasion to the "lowest point of the edge of the pyriform aperture" usually on both sides. I have skulls in my collection on which I defy anyone to define accurately the "lowest point of the edge of the pyriform aperture." Dr Morant criticised my measurement to the anterior nasal spine in my former paper. In order to find the degree of error which might possibly arise, I remeasured the nasal height in my Hokien and Tamil series to what I conceived might be the "lowest point of the edge of the pyriform aperture" and Table A gives the mean results.

Further comment is almost unnecessary except to add that the nasal spine requires no effort of the imagination to locate*.

I have to thank Dr Morant in the criticism aforementioned for pointing out the ambiguity of my description of orbital measurements. It not infrequently happens

* [It is because the tip of the nasal spine is so often worn down or broken off that the measurement to the pyriform aperture was selected by European craniologists in their Concordat; it is not peculiar to the Biometric Laboratory. Those who still use the nasal spine use, as far as I am aware, the *base*, and not the *tip* of the anterior nasal spine.—Ed.]

TABLE A.

Comparison of Mean Values of Nasal Height Measurements.*

Hokien		Tamil	
Nasion to Nasal Spine	Nasion to Pyriform Aperture	Nasion to Nasal Spine	Nasion to Pyriform Aperture
—	R=52·6	—	R=49·15
52·6	—	49·4	—
—	L=52·6	—	L=49·16

that a statement which is perfectly obvious to the writer is quite ambiguous to the reader. In my paper I stated that the height taken was the greatest in a vertical plane and the breadth the greatest breadth of orbit from dacryon at right angles to height. By this I meant to imply the width along the major axis of the elliptical cavity from the dacryon, and the height perpendicular to this width. Fortunately, I am not alone in lack of accuracy when describing points and measurements as I note that Professor Pearson† has taken to task practically every craniometrician of note including those who framed the "Frankfurter Verständigung" over the definition of the alveolar point. As regards the medium used for obtaining the cranial capacity, the mustard seed used by the Biometric Laboratory is, as they admit, liable to considerable variation from desiccation or absorption of moisture. In a tropical country like Singapore with an atmosphere almost saturated with moisture so that one's clothes and shoes are covered with mould in a few days, such a medium as mustard seed becomes impossible. I have accordingly measured the capacities with No. 8 shot following the careful system mentioned in my Hokien

* [The following rebutting evidence to show that in many cases there exists a difference may be cited here; it is taken from papers published before Prof. Harrower raised the question.

Race	From Nasion to Base of Spine (Broca's value) *NH'*	Frankfurt Concordat Height Nasion to Border of Pyriform Aperture	
		NH (*R*)	*NH* (*L*)
English, Farringdon Street ♂♀	51·0 ± ·25	51·8 ± ·21	51·7 ± ·20
„ „ „ ♀	47·2 ± ·23	48·1 ± ·20	48·0 ± ·20
„ Whitechapel ♂	50·3 ± ·22	51·2 ± ·20	—
Badari, Predynastic ♂	47·2	48·4	48·4
„ „ ♀	44·9	46·0	45·6
English, Neolithic ♂	52·0	50·6	—
„ Bronze Age ♂	51·8	49·1	—

It is clear from the probable errors provided that the differences may be significant, and that the nasal height measured in divergent manners may give results of the order of racial differences.—ED.]

† "Note: The Definition of the Alveolar Point," Karl Pearson. *Biometrika*, Vol. XVII.

and Tamil paper, so that the personal error, if any, is at least constant in my three series*. The measurements used in my paper are the following:

L = max. length from glabella to occiput in the median plane. B = max. breadth on parietal bones. B' = min. frontal breadth between temporal crests. H' = basi-bregmatic height. OH = auricular height from the auricular points measured on craniophor vertically upwards. LB = basi-nasal length. ON = length between opisthion and nasion. U = horizontal circumference through the ophryon (Flower). $G'H$ = distance between nasion and alveolar point. GB = face breadth between lowest points of zygomatic-maxillary sutures. J = max. breadth between zygomatic arches. NH = nasal height between ant. nasal spine and nasion. NB = nasal breadth between widest parts of rim of pyriform aperture. O_1 = width along the major axis of the elliptical cavity from the dacryon. O_2 = greatest height perpendicular to the width. G_1 = length of palate from post-nasal spine to a line joining the inner aspects of the medial incisors. G_2 = palatal breadth between inner aspects of 2nd molars. GL = length from basion to alveolar point. AD = asterionic diameter or distance between the asteria of the two sides. fml = length of foramen magnum. fmb = breadth of foramen magnum. W = weight of skull. Q = transverse arc through apex vertical to horizontal plane, ending at upper margins of external auditory meatuses. S = sagittal arc from nasion to opisthion. S_1 = arc from nasion to bregma. S_2 = arc from bregma to lambda. S_3 = arc from lambda to opisthion. S_1' = chord from nasion to bregma. S_3' = chord from opisthion to lambda. C = capacity measured directly by shot method†.

3. *Comparative Material.* Reliable comparative material is unfortunately scarce. For example the Malayan series quoted by Tildesley‡ and Morant§ has been collected from the various islands of the Malay Archipelago. There are Chinese, Malay, Javanese, Siamese, Dyak, Indian including all the different castes, Japanese and Negroid all hopelessly intermingled along the seaboard‖. Only in the remoter districts inland could one hope to obtain anything like a pure collection of Malay skulls and the Malays being of Mahommedan faith the making of such a collection is rendered more difficult. Even accepting the broader grouping suggested by Tildesley‡ the data from such a collection are useless for scientific comparison. Similarly with the so-called Hindu and Chinese material. The origin and source of the skulls are in my opinion much too obscure to be of any real value. The material collected by the brothers Sarasin in 1892—1894 is probably of doubtful origin also. The only Asiatic material available appears to me to be the Burmese A series of Tildesley‡, consisting of 44 crania (the B and C series being too short for

* [The point of the criticism is not that Prof. Harrower used shot, but that he compares in his papers capacities found by seed and by shot. The objection to shot is that it is too "sticky" to be shaken either in skull or measuring glass into the position of most tightly packed spheres, and of course shot cannot be used with ancient crania. The change of the volume of mustard seed with moisture is of no importance in the work of the Biometric Laboratory method, as it is continually controlled by the *crânes étalons*.—Ed.]

† [It is to be noted that Prof. Harrower's NH, O_1 and Q are not identical with the lengths denoted by these letters in the Biometric Laboratory.—Ed.]

‡ "A First Study of the Burmese Skull." *Biometrika*, Vol. XIII.

§ "A First Study of the Tibetan Skull." *Biometrika*, Vol. XIV.

‖ [A fact probably quite familiar to those who collected the crania.—Ed.]

comparative purposes), the 17 crania of the Tibetan A series and 15 crania of the Tibetan B series of Morant*, my own series of 35 Tamil and 36 Hokien crania† and the 88 crania of the Aino series the measurements of which are quoted in *Biometrika*, Vol. I. As an example of a primitive race I have included the series of 35 Moriori crania‡ for comparative purposes chiefly because a greater number of the necessary measurements were available. I wish to acknowledge my indebtedness to the papers of Tildesley and Morant for many of the measurements used in the comparisons.

4. *Comparison of the Mean Values and Indices.* A consideration of the capacity of the various races gives the following analysis.

TABLE I.

Classification of Skulls according to Mean Capacity.

Megalocephalic 1450 or over	Mesocephalic 1350—1449	Microcephalic 1349 or less
Tibetan B	Hylam	Modern Negroes
Hokien	Tibetan A	Tasmanians
Aino	Burmese A	Australians
Scottish	Naqada	
English	Tamil	
French	Moriori	
German		

Out of the six Asiatic series the Hokien and the Tibetan B means are megalocephalic. Possibly the Tibetan A mean is rather low due to the fact that the series may contain a few female crania. Tibetan A gives 47·1 °/₀ megalocephalic.

TABLE II§.

Analysis of Cranial Capacity in Asiatic Series.

Race	Megalocephalic		Mesocephalic		Microcephalic	
	No.	°/₀	No.	°/₀	No.	°/₀
Tibetan B (14) ...	11	78·58	3	21·42	—	—
Hokien (36) ...	23	63·90	6	16·66	7	19·44
Tibetan A (17) ...	8	47·06	5	29·41	4	23·53
Hylam (39) ...	15	38·41	17	43·39	7	18·20
Burmese A (27)...	9	33·33	12	44·44	6	22·23
Tamil (35) ...	8	22·87	10	28·57	17	48·56

Approximately 44 °/₀ of the Burmese and Hylam skulls fall in the mesocephalic group, only the Tibetan B having a distribution entirely above 1349 c.c., 78·5 °/₀

* "A First Study of the Tibetan Skull." *Biometrika*, Vol. XIV.

† "A Study of the Hokien and the Tamil Skull." *Trans. Roy. Soc. Edin.*, Vol. LIV. Part III. 1926.

‡ "A Study of the Crania of the Moriori," E. Y. Thomson. *Biometrika*, Vol. XI.

§ [The value of the percentages in Tables II—VIII considering the length of some of the series is open to doubt.—ED.]

being megalocephalic, and the Hokien series giving a distribution of 63·9 °/₀ megalocephalic. Hylam and Hokien series are both Chinese yet the means show a difference of 68·6 c.c. in cranial capacity. The difference between the Tibetan A and the Hylam means is only 5 c.c. and between the Hylam and Burmese A is 21·1 c.c. The difference between Hokien and Hylam is undoubtedly significant*.

Comparing the mean maximum lengths we find from Table III that the Hylam with a mean length of 168·25 mm. is by far the shortest of all the Asiatic groups compared, including the Aino. The Hylam is less than the Aino by 17·55 mm., Tibetan B by 17·25 mm., Hokien by 11·65 mm., Tamil by 11·35 mm., Tibetan A by 6·55 mm. and Burmese A by 5·25 mm. It will be noted that the Burmese A approaches the Hylam most closely although the difference of 5·25 mm. is considerable. Considering the mean maximum breadth the Hylam shows by far the greatest width with a mean of 147·79 mm. Detailing the differences we find that the Burmese A group again approaches most closely to the Hylam, the measurement being less than that of the Hylam by 4·09 mm., the Aino coming next with a difference of 6·59 mm., Hokien differing by 6·89 mm. The Tibetan A and B series have an equal divergence of 8·39 mm. and the narrow Tamil skull is less by 16·29 mm. These facts are indeed remarkable and the results are reflected in the cephalic indices derived from these measurements. Table IV gives an analysis of the cephalic indices. The mean cephalic index of the Hylam is very great at 87·89. Even among the European skulls the Altbayerisch German which has the highest index is only 83·2, a difference of 4·69. Confining ourselves, however, to the Asiatic series the Burmese A with an index of 82·9 is nearest our Hylam although it differs by 4·99 from the Hylam. The Tibetan A with a mean index of 79·8 comes next, the Hokien follows at 78·75 giving a difference of 9·14 from the Hylam. Yet Hokien and Hylam are both Southern Chinese. The Aino has an index of 76·5, the Tibetan B at 75·3 follows and the Tamil is lowest at 73·45, giving a maximum difference between Tamil and Hylam in their mean cephalic indices of 14·44. In other words the difference between the two Chinese groups Hokien and Hylam is 63·3 °/₀ of the maximum difference in the Asiatic series which exists between Tamil and Hylam. If we classify the results into the generally accepted groups of Dolichocephalic, Mesaticephalic and Brachycephalic we find the Hylam is 100 °/₀ Brachycephalic, the Burmese A 77·27 °/₀ Brachycephalic, the Hokien is only 25 °/₀ Brachycephalic, while the Tamil is 62·8 °/₀ Dolichocephalic.

Asiatics appear to have a tendency to a higher skull than Europeans as indicated by the basi-bregmatic height. The largest mean basi-bregmatic height quoted for Europeans is the Altbayerisch German at 133·78 mm.†, the lowest Asiatic height being that of the Tibetan A at 131·2 mm.. The Hylam gives a mean height of 135·96 mm. practically equal to the Burmese A at 136 mm. The Hokien mean is 137·8 mm. or 1·84 mm. greater than the Hylam, the maximum Asiatic being

* [We have here and in Tables I and II an illustration of the criticism made in the footnote, p. 248, i.e. the comparison of capacities found by mustard seed and shot.—Ed.]

† [Several European male groups rise to 136 mm., e.g. Anglo-Saxons 136·0, Serbo-Croats 136·4, Greeks 136·1, Mediaeval Bohemians 138·0.—Ed.]

TABLE III.

Comparative Table of Means. All Male.*

Character	Hylam (39)	Hokien (36)	Tamil (35)	Tibetan A	Tibetan B	Burmese A	Aino	Moriori
Capacity ...	1428·0	1496·6	1350·28	1433·0 (17)	1537·7 (14)	1406·9 (27)	1462·0 (76)	1422·1 (28)
Weight ...	621·7	656·0	575·0	525·4 (17)	673·1 (15)	656·8 (38)	—	—
L ...	168·25	179·9	179·6	174·8 (17)	185·5 (14)	173·5 (44)	185·8 (88)	186·9 (35)
B ...	147·79	140·9	131·5	139·4 (17)	139·4 (14)	143·7 (45)	141·2 (88)	141·4 (34)
H' ...	135·96	137·8	136·28	131·2 (17)	134·1 (15)	136·0 (43)	139·5 (88)	135·9 (34)
LB ...	96·44	98·3	101·5	95·7 (17)	99·2 (15)	98·5 (43)	105·4 (88)	105·6 (34)
GL ...	93·52	96·04	96·4	91·5 (17)	97·2 (15)	96·6 (39)	104·9 (69)	100·9 (34)
G'H ...	70·59	73·8	64·8	69·4 (15)	76·5 (15)	71·4 (39)	69·8 (73)	76·4 (35)
GB ...	99·73	99·3	97·5	98·7 (17)	100·7 (15)	101·9 (40)	102·1 (76)	103·2 (34)
ON ...	130·0	131·2	135·9	—	—	—	—	140·3 (34)‡
AD ...	105·64	107·6	103·7	—	—	—	—	—
B' ...	92·91	91·5	95·17	92·6 (17)	94·3 (15)	94·3 (44)	96·2 (88)	95·3 (35)
J ...	133·96	132·6	127·8	130·4 (17)	137·5 (15)	134·0 (40)	137·3 (74)	137·4 (34)
O_1L† ...	38·18	38·5	39·5	—	—	—	40·9 (79)†	44·4 (35)†
O_1R† ...	38·56	38·7	39·7	39·5 (17)	41·2 (15)	39·6 (41)	—	44·6 (35)†
O_2L ...	34·08	34·8	32·5	35·0 (17)	36·7 (15)	35·0 (41)	34·9 (79)	37·3 (34)
O_2R ...	33·65	34·6	32·2	35·0 (17)	36·5 (15)	35·0 (41)	—	37·6 (34)†
NH ...	51·57	52·6	49·4	51·7 (16)	54·9 (15)	53·4 (41)	50·5 (79)	57·3 (35)
NB ...	25·41	25·2	24·6	25·3 (17)	27·1 (15)	28·1 (41)	25·6 (78)	25·3 (35)
G_1 ...	48·53	49·0	50·2	47·7 (17)	51·5 (15)	49·9 (37)	53·0 (75)	53·1 (33)
G_2 ...	38·05	40·8	38·8	41·0 (15)	43·6 (15)	39·6 (40)	38·2 (74)	38·9 (34)
OH ...	117·67	119·3	116·3	113·2 (17)	115·5 (15)	117·7 (44)	119·3 (88)	117·1 (34)
U ...	500·14	510·5	498·0	503·6 (17)	525·6 (14)	505·7 (44)	522·5 (88)	522·8 (34)
Q ...	329·05	322·0	313·2	310·9 (17)	312·9 (14)	325·8 (43)	328·5 (84)	316·1 (34)
S ...	358·89	377·0	367·6	360·9 (17)	378·6 (14)	363·7 (44)	372·8 (77)	368·8 (34)
S_1 ...	125·57	132·0¶	128·8¶	125·8 (17)	129·3 (15)	128·6 (44)	—	126·0 (34)
S_2 ...	123·03	129·0¶	131·9¶	122·6 (17)	126·1 (14)	124·0 (45)	—	122·4 (34)
S_3 ...	110·04	117·0¶	106·8¶	112·5 (17)	122·7 (15)	111·2 (44)	—	121·1 (34)
S_1' ...	111·05	113·1	112·2	110·2 (17)	113·5 (15)	112·6 (44)	—	111·9 (33)‡
S_3' ...	95·76	99·25	92·38	94·4 (17)	100·3 (15)	94·7 (44)	—	102·3 (34)
fml ...	35·51	35·5	36·7	35·7 (17)	37·4 (15)	36·7 (43)	—	35·3 (33)
fmb ...	30·40	29·4	29·5	30·1 (17)	31·4 (15)	30·7 (42)	—	30·8 (34)
$100\,B/L$ ...	87·89	78·75	73·45	79·8 (17)	75·3 (14)	82·9 (44)	76·5 (88)	76·1 (34)
$100\,H'/L$ ...	80·84	77·02	76·21	75·1 (17)	72·1 (14)	78·4 (43)‡	75·6 (88)	72·8 (34)
$100\,B/H'$ ...	108·85	102·27	96·14	106·3 (17)	104·5 (14)	105·7 (43)‡	101·2 (88)‡	104·5 (34)
$100\,GL/LB$	96·96	97·01	94·55	95·61 (17)‡	98·0 (15)‡	98·12 (39)‡	99·49 (69)‡	95·6 (34)‡
$100\,G'H/GB$	70·78	73·8	66·72	70·4 (15)	76·0 (15)	69·8 (39)	68·4 (69)	74·1 (34)
$100\,G'H/J$‡	52·70	55·67	50·70	54·48 (17)	55·64 (15)	53·28 (39)	50·84 (73)	55·6 (34)
$100\,O_2/O_1, L$§	89·40	91·94	81·65	—	—	—	85·3 (79)‖	84·0 (34)‖
$100\,O_2/O_1, R$§	87·47	89·35	81·04	88·7 (17)	88·6 (15)	88·4 (41)‡	—	84·4 (34)‖
$100\,NB/NH$	49·40	48·15	51·64	49·3 (16)	49·5 (15)	52·8 (41)	50·7 (78)	43·9 (34)
$100\,G_2/G_1$ ...	78·89	83·48	79·66	86·5 (15)	84·1 (12)	79·8 (37)	72·1 (72)	73·2 (34)
$100\,fmb/fml$	85·90	82·98	80·17	84·3 (17)	84·1 (15)	83·8 (42)	—	87·4 (34)
Front. Ind. ...	68·32	68·91¶	65·32	66·25 (17)‡	66·40 (15)‡	66·11 (44)‡	—	68·7 (33)‡
Occip. Ind. ...	66·15	61·83	62·22	61·7 (17)	59·2 (15)	62·8 (44)	—	62·2 (34)
Angle *A* ...	70°·77	70°·5	75°·5	71°·8 (16)	68°·8 (15)	70°·5 (38)	71°·2 (69)‡	71°·8 (34)
" *N* ...	65°·77	65°·9	66°·43	64°·7 (16)	65°·5 (15)	66°·8 (38)	70°·2 (69)‡	64°·8 (34)
" *B* ...	43°·46	43°·6	38°·07	43°·5 (16)	45°·7 (15)	42°·6 (39)	38°·6 (69)‡	43°·4 (34)
" *P* ...	85°·52	84°·7	85°·5	87°·4 (15)	85°·7 (14)	86°·0 (39)	82°·0 (67)	84°·7 (34)
" θ_1 ...	28°·45	29°·2	28°·01	28°·0 (15)	28°·5 (15)	27°·2 (38)	—	38°·3 (34)
" θ_2 ...	14°·75	14°·3	10°·3	15°·5 (15)	17°·7 (14)	15°·4 (38)	—	12°·9 (34)
" for. mag.	6°·15	6°·0	8°·0	8°·3 (17)	12°·3 (15)	6°·0‡	—	−2°·5‡

* The sexing of Tibetan A is doubtful and the series is probably mixed. See Morant, *Biometrika*, Vol. XIV. p. 196. [This is hardly correct: the sex of only *three* could not *finally* be positively determined; see Appendix II following p. 260.—ED.]

† Orbital lengths measured from dacryon [except in the cases of Aino and Moriori, where the method of measurement is that of the Frankfurt Concordat.—ED.]

‡ Values calculated from means [or taken from type contours.—ED.]

§ Index derived from orbital lengths measured from dacryon.

‖ [Not comparable with other values of orbital index: see footnote † above.—ED.]

¶ Query for 132·0 read 128·0; for 128·8 read 129·4; for 129·0 read 130·6; for 131·9 read 129·8; for 117·0 read 118·1; for 106·8 read 109·0; for 68·91 read 68·6.

TABLE IV.

Analysis of the Cephalic Indices.

Race	Dolichocephalic under 75		Mesaticephalic				Brachycephalic 80 or over	
			B 75—77·4		A 77·5—79·9			
	No.	%	No.	%	No.	%	No.	%
Hylam (39)	—	—	—	—	—	—	39	100
Burmese A (44)	2	4·55	4	9·09	4	9·09	34	77·27
Tibetan A (17)	1	5·88	5	29·41	4	23·53	7	41·18
Hokien (36)	4	11·11	7	19·44	16	44·44	9	25·00
Tibetan B (15)	9	60·00	2	13·33	2	13·33	2	13·33
Tamil (35)	22	62·86	11	31·43	2	5·71	—	—

the Aino at 139·5 mm. or 8·3 mm. greater than the lowest, the Tibetan A group. As one would expect from the short head of the Hylam the vertical index tends to be high. An analysis of the vertical indices shows that 97·44 % of the Hylam skulls are Hypsicephalic, only one out of thirty-nine or 2·56 % being Metriocephalic. Burmese A is again the nearest at 79·07 % Hypsicephalic, Hokien 72·22 % and Tamil 60 % Hypsicephalic. Tibetan A is 58·82 % Hypsicephalic and Tibetan B 64·28 % Metriocephalic. Considering the mean indices the Hylam is highest at 80·84, Burmese A next at 78·4 or 2·44 less than the Hylam, the Hokien is 3·82 less than the Hylam, the Tibetan B being least at 72·1, and the maximum difference in the Asiatic series being 8·74 between Hylam and Tibetan B.

TABLE V.

Analysis of Vertical Indices.

Race	Chamaecephalic 70 or under		Metriocephalic 70·1—75		Hypsicephalic 75·1 or over	
	No.	%	No.	%	No.	%
Hylam (39) ...	—	—	1	2·56	38	97·44
Burmese A (43)...	—	—	9	20·93	34	79·07
Hokien (36) ...	—	—	10	27·78	26	72·22
Tamil (35) ...	—	—	14	40·00	21	60·00
Tibetan A (17) ...	1	5·88	6	35·29	10	58·82
Tibetan B (14) ...	2	14·29	9	64·28	3	21·42

The length from basion to nasion as one might anticipate in the short Hylam skull is relatively small having a mean length of only 96·44 mm. Yet in the Tibetan A series in which the glabellar-occipital length exceeds the Hylam by 6·55 mm., the basi-nasal length is 0·74 mm. less than that of the Hylam. The

Hokien basi-nasal length is 1·86 mm., the Burmese A 2·06 mm. greater than the Hylam. It is interesting to note that the Aino and Tibetan B series have approximately equal glabellar-occipital lengths yet the Aino basi-nasal length at 105·4 mm. exceeds the Tibetan B at 99·2 mm. by 6·2 mm.

The mean basi-alveolar lengths show a considerable range of variation in the Asiatic series, between 91·5 mm. in the Tibetan A and 104·9 mm. in the Aino, a difference of 13·4 mm. The Hylam at 93·52 mm. is second lowest on the list. The gnathic index obtained from these two measurements is more instructive. In the case of the Tibetan, Burmese and Aino series I have calculated the gnathic index from the means. Considering the mean indices we find that Hylam, Hokien, Tamil and Tibetan A have an orthognathous index, while Tibetan B, Burmese A and Aino have a mesognathous index. Analysing the individual indices we get the accompanying table which shows that Hokien and Hylam are approximately equally divided between the orthognathous and mesognathous groups, the Tamil being

TABLE VI.

Analysis of Gnathic Indices.

Race	Orthognathous 97·9 or under		Mesognathous 98—102·9		Prognathous 103 or over	
	No.	%	No.	%	No.	%
Tamil (35) ...	27	77·14	6	17·14	2	5·71
Hokien (36) ...	21	58·33	14	38·89	1	2·78
Hylam (39) ...	22	56·41	14	35·90	3	7·69

much more decidedly orthognathous with 77·14 % of skulls in this group as compared with 58·33 % in the Hokien and 56·41 % in the Hylam. As I noted in my paper on the Hokien and Tamil skulls the Tamil approaches very closely to the profile of the Scottish and of the Whitechapel English.

The orbital breadths used in this paper are those taken from the dacryon. The Hylam and Hokien are remarkably close in breadth measurement, being 38·56 mm. and 38·7 mm. respectively. The Tibetan A, Burmese A and Tamil are also very similar at 39·5 mm., 39·6 mm., and 39·7 mm., the Tibetan B giving the largest mean measurement at 41·2 mm. The mean orbital heights are respectively 33·65 mm., 34·6 mm., 32·2 mm., 35·0 mm., 36·5 mm. and 35·0 mm. for the Hylam, Hokien, Tamil, Tibetan A, Tibetan B and Burmese A series. The indices derived from these two measurements are given in Table VII. There is a remarkable coincidence in the two Chinese series in the difference of the indices of the right and left orbits. In the case of the Hokien the right index exceeds the left by 2·59 and in the Hylam the right also exceeds the left by 1·93. Considering only the right indices we see that the mean index for Burmese Tibetan and Hylam falls in the mesosemic group, the Hokien in the megasemic and the Tamil very definitely in the microsemic

TABLE VII.

Analysis of Right Orbital Indices.

Race	Microsemic under 84		Mesosemic 84—89		Megasemic over 89	
	No.	°/₀	No.	°/₀	No.	°/₀
Hokien (36) ...	5	13·89	7	19·44	24	66·67
Tibetan A (17) ...	4	23·53	4	23·53	9	52·94
Tibetan B (15) ...	3	20·00	5	33·33	7	46·67
Hylam (39) ...	10	25·69	15	38·41	14	35·90
Tamil (35) ...	26	74·29	5	14·29	4	11·43

group. A closer analysis of the figures of the right side shows that 35·9 °/₀ Hylam are megasemic as opposed to 66·67 °/₀ Hokien. Even in the Tibetan groups 53 °/₀ in the A and 46·67 °/₀ in the B group are megasemic. The Hylam are apparently not so distinctly megasemic as the Hokien.

The nasal height and breadth call for no special comment. Table VIII gives an analysis of nasal indices for the Asiatic groups. The means all fall in the mesorrhine group, but taking the individual indices we find that 58·33 °/₀ Hokien are leptorrhine while only 33·33 °/₀ Hylam are leptorrhine: 33·33 °/₀ of Hokien and 48·72 °/₀ Hylam are mesorrhine so that their positions in the groups are reversed. It is noteworthy that 48·57 °/₀ Tamils are mesorrhine. The Burmese A gives the highest mean at 52·8 which is only 0·2 below the lower limit set for the platyrrhine group. The table shows that 41·47 °/₀ are mesorrhine and 46·34 °/₀ are platyrrhine in the Burmese A series. The highest of the European indices is that of the Altbayerisch German at 48·7 *, all other European mean indices being definitely in the leptorrhine group.

TABLE VIII†.

Analysis of Nasal Indices.

Race	Leptorrhine 48 or under		Mesorrhine 48·1—49·9		Platyrrhine 50 or over	
	No.	°/₀	No.	°/₀	No.	°/₀
Hokien (36) ...	21	58·33	12	33·33	3	8·33
Tibetan A (17) ...	8	47·06	5	29·41	4	23·53
Tibetan B (15) ...	6	40·00	6	40·00	3	20·00
Hylam (39) ...	13	33·33	19	48·72	7	17·95
Tamil (35) ...	7	20·00	17	48·57	11	31·43
Burmese A (41)...	5	12·19	17	41·47	19	46·34

* *Biometrika*, Vol. I. p. 426.

† In the Tibetan and Burmese series the indices are obtained from the length measured to the lower margin of pyriform aperture on right side. In my series the length is taken to anterior nasal spine. See p. 246 of this paper.

The nasi-alveolar mean height in the Hylam is substantially less than that of the Hokien, the difference being 3·21 mm. The Tibetan A and Burmese A approximate to the Hylam with measurements of 69·4 mm., 71·4 mm. and 70·59 mm. respectively. The Tibetan B has a fairly high mean at 76·5 mm. which does not appear to be entirely due to the larger size of the skull but is possibly a characteristic of the type. It is a little surprising to find a primitive people like the Aino with a low mean measurement, namely, 69·8 mm., as compared with the Moriori at 76·4 and the Tibetan B at 76·5 mm., although the modern Negro has a still smaller measurement at 68·0 mm. The Tamil mean at 64·8 mm. is the smallest of all races compared and is less than the Tibetan B by 11·7 mm. or an amount equal to 18 % of the Tamil mean nasi-alveolar height. The face breadth means of the Asiatic series are fairly equal, the most notable feature being the difference between the European series and the Asiatic. The lowest Asiatic, namely the Tamil, is 97·5 mm. while the lowest European mean is 90·12 mm. for Young's Scottish series*. The highest Asiatic mean is the Aino at 102·1 mm. (omitting the Fuegians at 110·0 mm. quoted by Morant† but which appears to be questioned by him) while the highest European mean is 95·1 mm. for the Altbayerisch German series. The minimum Asiatic face breadth is thus 2·4 mm. greater than the maximum in the European series. The facial index of the Hylam at 70·78 is most closely related to the Tibetan A at 70·4. The Hokien mean index at 73·8 is 3·02 higher than the Hylam.

The Hylam interzygomatic breadth at 133·96 mm. is approximately equal to the Burmese A at 134 mm. The Tibetan B gives the highest mean at 137·5 mm. closely followed by the Aino at 137·3 mm. The Tibetan A is noticeably low at

TABLE IX.

Comparison of Facial Indices.

Race	100 *G'H/J* (Kollman)	100 *G'H/GB*
Tamil	50·70	66·72
Aino	50·84	68·4
Hylam	52·70	70·78
Burmese A ...	53·28	69·8
Tibetan A ...	54·48	70·4
Tibetan B ...	55·64	76·0
Hokien	55·67	73·8

130·4 mm., the narrow Tamil skull giving the lowest value at 127·8 mm. or 9·7 mm. less than the Tibetan B. I have added Kollman's facial index for comparison, the indices being calculated from the means only. Table IX gives the values tabulated. It will be noted that the Burmese A approaches most nearly to the Hylam.

* "A Contribution to the Study of the Scottish Skull." *Trans. Roy. Soc. Edin.*, Vol. LI. Part II. 1916.

† "A First Study of the Tibetan Skull." *Biometrika*, Vol. XIV. [Originally given in *Biometrika*, Vol. XI. p. 98, and the query signifies that it was deduced by average allowance from the bizygomatic breadth. The value of *GB* for 20 Fuegian ♂ crania is 101·5 mm. As non-Asiatic the Fuegians hardly come into consideration here.—ED.]

The mean palatal lengths of Hylam and Hokien are nearly equal at 48·53 and 49·0 mm. respectively. The Tibetan A is shortest at 47·7 mm., the Aino being highest in the Asiatic series at 53 mm. Curiously enough in spite of the great breadth of the Hylam skull the mean palatal breadth is smallest at 38·05 mm., being 2·75 mm. less than the Hokien and nearly equal to the Aino which gives a mean of 38·2 mm. Accordingly, the palatal indices reflect these differences. The Aino mean index is lowest at 72·1, the Hylam coming next at 78·89, closely followed by the Tamil and Burmese A at 79·66 and 79·8 respectively. The Hokien gives an index of 83·48, the Tibetan B of 84·1 and the Tibetan A of 86·5. There is thus an actual difference of 14·4 between the lowest Asiatic mean palatal index, namely the Aino, and the highest, found in the Tibetan A.

A comparison of the foramen magnum measurements shows little of note. The Hylam index is the largest of the Asiatic series probably in conformity with the large maximum breadth of the skull. At 85·9 it is nearly 3 °/₀ greater than the Hokien index and nearly 6 °/₀ greater than the Tamil which shows the lowest index at 80·17.

In spite of the great breadth of the Hylam skull the horizontal circumference is 10·46 mm. less than the Hokien. The large breadth is counterbalanced by the short length and a consideration of these points and the capacity of the skull would lead one to expect a smaller circumference. The Hylam circumference is only 2·14 mm. greater than the Tamil although the Tamil mean length is 11·35 mm. greater than the Hylam and the breadth is 16·29 mm. less than the Hylam. The Burmese A mean horizontal circumference at 505·7 mm. is nearest to the Hylam*. The Tibetan B and Aino have each very large circumferences at 525·6 and 522·5 mm. respectively.

The transverse arcs measured from one auricular orifice to the other over the vault may be influenced by the personal factor on account of individual ideas on the location of the upper margin of the external auditory meatus. The three series Hylam, Hokien, and Tamil will, at least, have the same personal error. Even allowing for the personal equation it is obvious that the Hylam skull has a larger transverse arc than any other of the Asiatic series, perhaps excepting the Aino which gives a mean measurement of 328·5 mm. as compared with the Hylam at 329·05 mm. The Burmese A at 325·8 mm. has a closer approximation to the Hylam than has the Hokien which gives a mean of 322·0 mm. The auricular heights are also interesting, the Hokien mean measurement being 119·3 mm. as compared with the Hylam mean at 117·67 mm. It is thus apparent that the greater transverse arc of the Hylam is due to the greater breadth and not to the height of the skull. The mean auricular height of the Burmese A at 117·7 mm. equals the Hylam at 117·67 mm.

Considering the minimum frontal breadths the Hokien gives the shortest mean at 91·5 mm., the Hylam occupying the third place in the Asiatic series at 92·91 mm., or 1·41 mm. greater than the Hokien. The Tamil, in spite of his narrow maximum

* [Both Tamil (498·0) and Tibetan A (503·6) appear to be nearer to the Hylam (500·1) than the Burmese A (505·7).—Ed.]

breadth, gives a large minimum breadth of 95·17 mm., being exceeded by the Aino only at 96·2 mm., the nearest approach to the Tamil being the Burmese A and Tibetan B, each having a mean of 94·3 mm.

The sagittal arcs are added for comparison with other series. As I pointed out in my former paper* the whole arc, and the frontal arc nasion to bregma, are the only measurements of real value due to the difficulty of locating the lambda. The Hylam gives the shortest mean sagittal arc value for the Asiatic series being 358·89 mm. while the Hokien mean is the second longest at 377·0 mm. which is exceeded for the Tibetan B by 1·6 mm. only. It is surprising to find two Chinese peoples, both of Southern China, nearly at opposite extremes in sagittal arc measurement, among the Asiatic series under discussion. The difference is no small amount but actually 18·11 mm., and it appears to be fairly equally distributed between the different segments of the arc. With reference to the parietal segment of the arc, it is interesting to note the high mean for the Tamil, namely, 131·9 (? 129·8) mm., which is the largest for the Asiatic series, the Tibetan A being smallest at 122·6 mm., and the Hylam value being 123·03 mm. On the other hand, the mean occipital arc of the Tamil is the shortest among the Asiatic series giving a value of 106·8 (? 109·0) mm., the Hylam next at 110·04 mm., which is very close to the Burmese A at 111·2 mm., the Hokien value being 117·0 (? 118·1) mm., and the Tibetan B value being highest at 122·7 mm.

As an index of frontal protrusion I suggested in my previous paper that we might use the expression

$$\text{Frontal Index} = \text{Fr. I.} = 100\,\frac{S_1}{S_1'}\sqrt{\frac{S_1}{24\,(S_1 - S_1')}},$$

which was given by Pearson to Macdonell in 1906 as a measure of the occipital protrusion. Tildesley in her paper on the Burmese crania† gives the values of the function from 1·050 to 1·500. It is the expression used by the Biometric School for the occipital index. Morant takes exception to its use for frontal protrusion on account of the irregularity of the curve due to the glabella‡. A glance at the sagittal contours will, however, show that the objection cannot be sustained when we consider the irregularity of the curve produced by the external occipital protuberance. Further, in my opinion the index applied to the frontal protrusion has a greater value than when applied to the occipital, for two reasons: (1) the points between which the chord and the arc are measured, namely the nasion and bregma, are much better defined than the lambda from which the occipital segment is measured; (2) the degree of protrusion of the frontal region is an indication of the development of the underlying frontal lobes of the brain and, as such, is

* "A Study of the Hokien and the Tamil Skull," Gordon Harrower. *Trans. Roy. Soc. Edin.*, Vol. LIV. Part III. 1926.

† "A First Study of the Burmese Skull," M. L. Tildesley. *Biometrika*, Vol. XIII.

‡ "The Use of Biometric Methods applied to Craniometry," G. M. Morant. *Biometrika*, Vol. XVIII.

TABLE X.

Comparison of Frontal and Occipital Indices.

Race	Fr. In.*	Occ. In.
Tamil	65·32	62·22
Burmese A ...	66·11	62·8
Tibetan A ...	66·25	61·7
Tibetan B ...	66·40	59·2
Hylam ...	68·32	66·15
Hokien ...	68·91 (?68·6)	61·83

therefore a measure of racial intelligence†. Table X shows the frontal and occipital indices tabulated. From this it will be seen that the frontal protrusion is nearly equal to the occipital in the Hylam, a condition differing widely from that of the Hokien in which the difference between frontal and occipital indices amounts to 7·08 (?6·8). The degree of frontal protrusion in the Hokien and the Hylam is approximately equal, the flattening in the Hokien being very slightly greater than in the Hylam. The main difference lies in the occipital index where, the radii of curvature approaching equality, the shortening of the occipital chord in the Hylam gives an index showing a greater flattening.

I can now add the ratio of base line (opisthio-nasal length) to total sagittal arc with the results given by Cleland‡ and Young§ (Table XI). Unfortunately, the opisthio-nasal lengths for Burmese and Tibetan crania are not available‖. Although the mean sagittal arc of the Hokien is so much greater than that of the Hylam, yet the Hokien mean opisthio-nasal length is only 1·2 mm. greater than that of the Hylam, the Tamil opisthio-nasal length being 5·9 mm. greater than the Hylam. The ratio of arc to base line is therefore less in the Hylam than in the Hokien.

5. *Homogeneity of the Series.* To test the heterogeneity of a series we may take the standard deviations for length and breadth. According to Pearson, if the series under consideration gives a standard deviation which for length or breadth exceeds 6·5, heterogeneity should be suspected; if the standard deviation for length is less than 5·5 or for breadth less than 3·3, the series is a stringently selected sample. Table XII gives the S.D. for length, breadth and cephalic index. It will be noted that the Hylam series is in the category of a stringently selected series so far as length is concerned and is a heterogeneous series when the breadth test is applied¶. Possibly, to avoid such anomalous results, Morant** uses the standard

* Tibetan and Burmese frontal indices calculated from means [and so not strictly comparable.—Ed.]

† "Essays on the Evolution of Man," G. Elliot Smith. Oxford University Press. 1924.

‡ See *Phil. Trans.*, Vol. 160, p. 124. 1870.

§ "A Contribution to the Study of the Scottish Skull," M. Young. *Trans. Roy. Soc. Edin.*, Vol. LI. Part II. 1916.

‖ [Burmese A 132·6, Burmese B 132·1, Burmese C (Karens) 136·0; Tibetan A 131·0, Tibetan B 136·1. See *Biometrika*, Vol. XIII. pp. 203—5, and Vol. XIV. pp. 243—4.—Ed.]

¶ [Not at all; the probable errors of both standard deviations for length and breadth indicate that the Hylam values may both lie between 5·5 and 6·5.—Ed.]

** "A First Study of the Tibetan Skull," G. M. Morant. *Biometrika*, Vol. XIV. p. 205.

TABLE XI.

Relation of Base Line to Total Sagittal Arc.*

(Males only.)

Race	Opisthio-Nasal Length	Sagittal Arc	Ratio
Hylam ...	130·0	358·9	1 to 2·76
Hokien ...	131·2	377·0	1 „ 2·87
Tamil	135·9	367·6	1 „ 2·70
Scottish ...	134·53	378·6	1 „ 2·81
French† ...	136·14	355·60	1 „ 2·61
German ...	133·10	376·43	1 „ 2·82
Irish	132·84	386·84	1 „ 2·91
Australian ...	138·43	366·27	1 „ 2·65

TABLE XII.

Race	Standard Deviation					
	Length	No.	Breadth	No.	100 *B/L*	No.
Naqada	5·722 ± ·24	130	4·612 ± ·19	130	2·80 ± ·12	130
Aino	5·936 ± ·30	88	3·987 ± ·20	88	2·41 ± ·12	88
English (Whitechapel)	6·27 ± ·26	131	5·28 ± ·22	131	3·26 ± ·14	131
Hokien	5·995 ± ·48	36	5·026 ± ·40	36	3·26 ± ·26	36
Hylam	5·022 ± ·38	39	6·756 ± ·52	39	4·41 ± ·34	39
Tamil	6·736 ± ·54	35	4·742 ± ·38	35	3·14 ± ·25	35
Tibetan A	6·543 ± ·57	17	7·375 ± ·71	17	3·87 ± ·45	17
Tibetan B	8·339 ± 1·03	15	5·879 ± ·72	15	5·00 ± ·61	15
Burmese A	6·327 ± ·46	44	5·351 ± ·38	45	4·30 ± ·31	44

* [The following additional material may be of interest:

Race (Males)	Opisthio-Nasal Length	Sagittal Arc	Ratio
Karens	136·0	367·4	1 to 2·70
Burmans	132·6	363·7	1 „ 2·74
Tibetan A (1st Series) ...	131·0	360·9	1 „ 2·75
Nepalese	132·1	364·9	1 „ 2·76
Tibetan A (2nd Series) ...	131·0	361·2	1 „ 2·76
Tibetan B	136·1	378·6	1 „ 2·78
Burmese B	132·0	367·0	1 „ 2·78
Anglo-Saxon	139·0	389·0	1 „ 2·80
English (17th century) ...	134·3	378·8	1 „ 2·82
Hindoo	129·1	363·5	1 „ 2·82

—ED.]

† [The results for the last four races are due to Cleland, *Phil. Trans.*, Vol. 160, p. 124. But as the series only contain 6, 5, 6 and 6 individual crania respectively, they are of no real value.—ED.]

deviation for cephalic index which is a percentage of breadth compared with length. There is no indication however of the limits within which a series may be considered homogeneous. Morant* quotes the S.D. of 100 B/L for several races together with the probable error. In the values quoted the P.E. does not appear to have been calculated by the same formula for all races, the Chinese and Malayans being obtained from the formula ·67449 S.D./$\sqrt{2m}$, the others from the formula S.D./$\sqrt{2m}$. In Table XII I give the probable errors calculated from the former formula†. To complete the Table, I have calculated the S.D. for length and breadth for the Tibetan and Burmese series from the measurements given by Tildesley and Morant in their papers. It will be seen that the Tibetan A series gives a fairly high value for the S.D. of breadth and the Tibetan B series a still higher value for the S.D. of length which, according to Pearson, would exclude them from the category of a homogeneous series‡.

6. *Comparison of the Values of the Function*

$$\alpha = \frac{n_s n_{s'}}{n_s + n_{s'}} \left(\frac{M_s - M_{s'}}{\sigma_s} \right)^2.$$

If the difference of two mean characters be divided by the probable error of that difference, we have

$$\frac{M_s - M_{s'}}{\cdot 67449 \sqrt{\frac{\sigma_s^2}{n_s} + \frac{\sigma_{s'}^2}{n_{s'}}}},$$

where M_s is the mean, and σ_s is the S.D. based on n_s individual measurements of one race, and $M_{s'}$, $\sigma_{s'}$ and $n_{s'}$ are the corresponding characters of the race to be compared, an expression which will give an approximation which may be used for comparative purposes. Assuming the S.D. of the race to be compared may be taken as equal to the S.D. of the longest homogeneous series measured, we have by squaring a function

$$\alpha = \frac{n_s n_{s'}}{n_s + n_{s'}} \left(\frac{M_s - M_{s'}}{\sigma_s} \right)^2.$$

This function has been used by workers in the Biometric Laboratory to test individual racial differences. The standard deviations of the various measurements of the longest series available are those of the 26th to the 30th Dynasty Egyptian series preserved in the Biometric Laboratory and are the constants used in my calculations. If the value of the function is between 0·0 and 2·7 it suggests common origin. If between 2·7 and 6·1 common origin is uncertain, and above 6·1 it is highly

* "A First Study of the Tibetan Skull." *Biometrika*, Vol. XIV. p. 205.

† [Had Prof. Harrower referred to the original papers in *Biometrika* he would have found the probable errors of the standard deviations correctly given. By some slip Dr Morant in his short table has cited them incorrectly.—ED.]

‡ [Both again, *having regard to their probable errors*, are not significantly different from 6·5, and therefore are not necessarily to be suspected. It is also not customary to calculate standard deviations on less than 20 individuals.—ED.]

improbable*. Table XIII gives the values of the function for the Hylam compared with other Asiatic races, the Moriori being added as an example of a primitive people for which most of the necessary values are available. A glance at the Table

TABLE XIII.

Values of $\frac{n_s n_{s'}}{n_s + n_{s'}} \left(\frac{M_s - M_{s'}}{\sigma}\right)^2$ *for Hylam and other Races.*

Character		Hokien	Tamil	Tibetan A	Tibetan B	Burmese A	Aino	Moriori
Indices	B/L ...	219·4	545·0	108·7	229·1	72·23	491·8	361·2
	H'/L ...	31·62	46·1	45·13	91·06	14·09	85·85	135·5
	B/H' ...	43·82	159·0	4·162	10·54	10·97	85·53	18·53
	Occipital ...	48·66	26·08	21·54	48·07	21·305	—	[26·39]
	$G'H/GB$ ...	6·939	26·11	0·101	12·00	0·751	5·612	8·111
	O_2/O_1, R ...	2·536	29·51	0·598	0·543	0·540	17·21†	20·71†
	NB/NH ...	2·004	6·256	0·008	0·007	15·83	3·01	37·54
	fmb/fml ...	7·461	17·83	0·904	1·071	2·659	—	1·216
	G_2/G_1 ...	8·551	0·234	13·58	5·738	0·341	5·654	12·71
Angles	P ...	1·119	0·001	3·649	0·032	0·428	29·1	0·116
	N ...	0·029	0·724	1·213	0·072	1·864	44·64	1·556
	A ...	0·114	34·015	1·029	3·512	0·117	0·385	0·016
Lengths	L ...	77·40	71·40	15·46	93·10	17·36	253·4	192·9
	B ...	39·22	213·1	36·76	32·02	15·42	51·81	32·64
	B' ...	2·268	5·666	0·069	1·276	2·435	17·83	9·041
	OH ...	2·93	2·013	13·93	5·998	0·001	4·231	0·347
	LB ...	4·109	29·57	0·411	5·236	4·276	137·7	96·4
Arcs	Q or Q' ...	9·879	48·36	41·03	28·26	2·273	0·085	31·96
	S ...	31·16	9·03	0·306	20·32	3·057	32·02	11·37
	U ...	10·22	0·517	0·672	34·72	3·156	70·09	48·23
Face	$G'H$ ...	11·20	35·44	0·891	21·98	0·742	0·921	35·69
	J ...	1·658	33·08	7·182	6·501	0·002	13·64	10·26
Nose	NH ...	2·329	10·15	0·023	13·76	7·851	3·506	70·10
	NB ...	0·263	3·812	0·046	9·876	86·86	0·300	0·072
Orbit	O_1R ...	0·132	8·481	3·751	21·51	7·751	69·28†	251·25†
	O_2R ...	5·569	10·49	5·914	24·12	9·986	4·932	51·8
Palate	G_1 ...	0·373	4·474	0·736	7·759	3·214	46·25	33·68
	G_2 ...	20·46	1·48	13·63	45·86	6·858	0·083	1·892
For. Mag.	fml ...	0·000	4·224	0·070	6·344	4·747	—	0·129
	fmb ...	4·05	3·189	0·133	2·344	0·394	—	0·627
Capacity	C ...	6·838	8·533	0·056	9·626	0·870	2·308	0·046

will show that the Hylam is outside the range of common origin with any of the races with which he is compared. Out of 31 characters compared, 14 in the Burmese A, 12 in the Hokien, 6 in the Tamil and the Aino, 17 in Tibetan A, 7 in Tibetan B and 10 in the Moriori are within the values 0·0—2·7. Values above 6·1 are shown by 10 characters in Tibetan A, 12 in Burmese A, 15 in the Hokien, 20 in Tibetan B, 15 in the Aino and 21 in the Moriori and 20 in the Tamil.

* See Morant: "A First Study of the Tibetan Skull." *Biometrika*, Vol. XIV. p. 212.

† [These values are based for Hylam on the dacryal orbital widths, and for Aino and Moriori on the non-comparable "Lichtung zwischen den Augenhöhlenrändern." There are also differences in the manners of measuring the nasal height.—ED.]

7. *Coefficient of Racial Likeness.* Based on the function

$$\frac{n_s n_{s'}}{n_s + n_{s'}} \left(\frac{M_s - M_{s'}}{\sigma_s}\right)^2,$$

Pearson (*Biometrika*, Vol. XVIII. p. 107) suggests the formula

$$\frac{1}{m}\left\{S\frac{(M_s - M_{s'})^2}{\frac{\sigma_s^2}{n_s} + \frac{\sigma_{s'}^2}{n_{s'}}}\right\} - 1 + \frac{2}{m}$$

as a Coefficient of Racial Likeness which will rapidly show which races are most nearly alike and those which diverge most widely. The probable error of the deviation of the coefficient is given as $\cdot 67449\sqrt{2/m}\sqrt{1-1/m}$.

Assuming the standard deviations are equal, the formula becomes

$$\text{C.R.L.} = \frac{1}{m} S\left\{\frac{n_s n_{s'}}{n_s + n_{s'}}\left(\frac{M_s - M_{s'}}{\sigma_s}\right)^2\right\} - 1 \pm \cdot 67449\sqrt{2/m}\sqrt{1-1/m}.$$

Table XIV gives the C.R.L.'s of Asiatic races compared with the Hylam. Taking into consideration all 31 characters, the lowest coefficient obtained is that from the Burmese A data, namely 9·27, the other races in order being Tibetan A, Hokien, Tibetan B, Tamil, Moriori and Aino. Comparing only angles and indices the coefficients are greater, the lowest again being the Burmese A at 10·76 for 12 characters, the highest being the Aino at 75·879 for 10 characters. According

TABLE XIV.

Coefficients of Racial Likeness. All Male.

Hylam.

Race	All Characters			Indices and Angles only		
	C.R.L.	Probable Error	Number of Characters	C.R.L.	Probable Error	Number of Characters
Burmese A ...	9·27	±·17	31	10·76	±·26	12
Tibetan A ...	10·022	±·17	31	15·718	±·26	12
Hokien ...	18·429	±·17	31	30·021	±·26	12
Tibetan B ...	24·560	±·17	31	32·479	±·26	12
Tamil ...	43·963	±·17	31	73·238	±·26	12
Moriori* ...	48·188	±·17	30	53·291	±·27	11
Aino* ...	53·710	±·18	27	75·879	±·29	10

to the Biometric School the computation of the coefficient for angles and indices only was suggested to provide a measure of difference of shape apart from difference

* [Slight changes are needful in the coefficients of these races with the Hylam, as their orbital widths and orbital indices cannot be used. We have:

Moriori.....	42·01	±·18	28	56·65	±·29	10
Aino	54·63	±·19	25	82·51	±·30	9

It is a little surprising that the high values of "a" for orbital width have made so little change in the coefficients.—Ed.]

of size. The C.R.L. for angles and indices only, shows that the Hylam is further removed in shape from his Chinese neighbour the Hokien than from the Burmese A or Tibetan A groups, the C.R.L. for Burmese A being 10·76, Tibetan A 15·718, and Hokien 30·021 for indices and angles only, 12 characters.

8. *Study of the Type Contours of the Hylam Crania.* With the skull orientated in the Frankfurt plane I made sagittal and vertical contour tracings of the individual crania. From the mean values of the different measurements I have constructed the type contour tracings. The sagittal tracings are drawn through prosthion, nasion, glabella, bregma, vertex, lambda, gamma, inion, opisthion and basion. I took the precaution of marking all points on the skulls before commencing the tracings. Ordinates are drawn from the nasion-gamma line as indicated in the diagram, and maximum subtenses drawn to the various chords to obtain the curvatures. The sphenion I have arbitrarily determined as the point where an arc of radius 2 cm. cuts the basi-sphenoidal outline with the basion as centre. The abbreviations used on the contour are as follows:

N=Nasion. G=Glabella. *Bas.*=Basion. β=Bregma. V=Vertex. *Alv.*=Prosthion*. λ=Lambda. γ=Gamma, which is a point marked on the posterior aspect of the skull at the same height as the Nasion when the skull is orientated in the Frankfurt horizontal plane. *In.* = Inion. *Op.* = Opisthion. *Sp.* = Sphenion. *P.N.S.* = tip of Posterior Nasal Spine. *N.S.* = tip of Anterior Nasal Spine. L = lower end of Nasal Suture. $\angle A$ = Angle NAB. $\angle B$ = Angle NBA. $\angle N$ = Angle BNA. $\angle \theta_1$ = Angle $BN\gamma$. $\angle \theta_2$ = Angle Basion-Prosthion line makes with the Frankfurt horizontal plane. $\angle P$ = Angle Nasion-Prosthion line makes with the Frankfurt horizontal plane. $\angle fm.$ = Angle Basion-Opisthion line makes with the Frankfurt horizontal and indicates the trace on the median plane of the plane of the Foramen Magnum.

Table XV gives the mean values from which the sagittal type contour is constructed. Comparing the Hylam sagittal type contour with the Hokien we note that the frontal curvatures as well as the nasal and premaxillary regions are remarkably similar, the great divergence being in the occipital region where the Hokien type contour projects considerably beyond that of the Hylam. The angles of the fundamental triangle in the two tracings approximate closely the one to the other, the base or nasi-alveolar length being slightly longer in the Hokien than the Hylam. Compared with the Tibetan A type we find the Hylam bregmatic region rather higher than the Tibetan A, the latter having an occipital bulge projecting beyond the Hylam which, however, is not so marked as in the Hokien. The angles of the fundamental triangle show a greater divergence, the angle N being 1° more in the Hylam than in the Tibetan A, yet the Tibetan A resembles more closely the Hylam than does the Hokien. Superimposing the Hylam on the Burmese A contour we find that the sagittal arcs approximate still more closely than do the arcs of the Tibetan A or Hokien contours. The Burmese nose appears to be much flatter than the Hylam. The premaxillary region is not traced in the Burman. The angles

* [I think it impossible to identify Prosthion and Alveolar Point; the distinction is important having regard to the sides and angles of the fundamental triangle: see *Biometrika*, Vol. XVII. p. 53.—ED.]

TABLE XV.

Mean Values used in Plotting the Sagittal Type Contour.

Hylam Series (39 male Crania).

		Mean Value			Mean Value
$N\gamma$		163·49	Lambda	x from γ	1·58
Vertex	x from N	92·35		y	35·49
	y	91·0	Inion	x from γ	4·19
Bregma	x from N	67·58		y	21·18
	y	88·35	Opisthion	x from γ	43·80
Glabella	x from N	2·75		y	50·04
	y	10·84	Basion	from γ	91·5
Ordinates above $N\gamma$	0	27·87		„ N	95·42
	$N\frac{1}{4}$	41·74	Alveolar Pt.	„ N	70·59
	1	60·91		„ B	93·53
	2	74·30	*P.N.S.*	x from N	42·16
	3	82·61		y	49·21
	4	87·55	Sphenion	x from N	69·04
	5	89·94		y	34·47
	6	90·43	*N.S.*	x from N	5·98
	7	87·76		y	50·96
	8	81·01	Nose	NL' *	20·71
	9	67·95		NL	23·21
	$\gamma\frac{1}{4}$	46·23	Frankfurt below	$N\gamma$	27·91
	$\gamma\frac{1}{8}$	39·05	Frontal Max. Subtense to $N\beta$	x from N	51·39
	$\gamma=10$	25·78		y	24·55
	γ	0·00	Parietal Max. Subtense to N In.	x from N	91·51
Ordinates below $N\gamma$	8	46·73		y	103·07
	9	35·30	Occipital Max. Subtense to γ Op.	x from γ	27·83
	$\gamma\frac{1}{2}$	27·86		y	13·46
	$\gamma\frac{1}{4}$	21·08			

of the fundamental triangle differ but slightly in Hylam and Burman tracings. The Burmese A type tracing is slightly longer and in consequence the occipital region projects slightly beyond the Hylam. Compared with the Tamil, the Hylam frontal region is much flatter than the Tamil, the vertex higher and the occipital much less projecting. The nasi-alveolar length is much shorter in the Tamil, and in consequence the angle B is much smaller, the actual difference being 5°·39, while the angle A is 4°·73 greater than the corresponding angle in the Hylam. There is no similarity whatever between the Tamil and the Hylam contours. The Tibetan B when compared with the Hylam is obviously of larger dimensions. The frontal region is low compared with the Hylam, the glabella more pronounced, the vault of the cranium much flatter, while the occipital region bulges to the extent of 2 cm. beyond that of the Hylam when the $N\gamma$ lines are superimposed. The nasi-alveolar length is much greater, indicating a long type of face, and in consequence the angles A and B of the fundamental triangle differ materially. The angle B is 2°·24 greater, and the angle A 1°·97 less, than in the Hylam. The difference is not so marked as in the comparison of Tamil and Hylam. The most pronounced feature in the Tibetan B contour is the marked projection in the neighbourhood of the inion.

* L' is point where NL crosses the outline of the nasal bones.

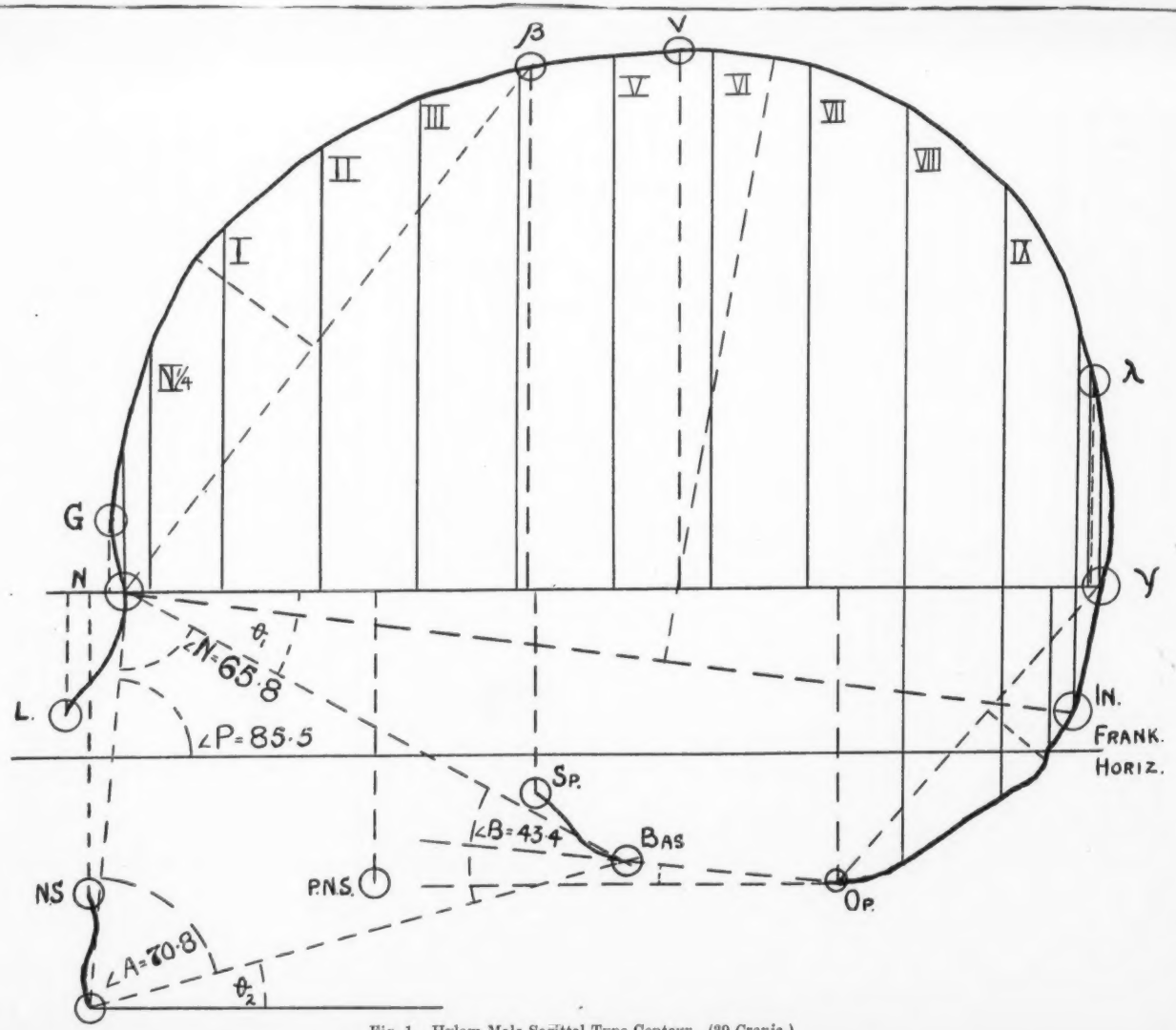

Fig. 1. Hylam Male Sagittal Type Contour. (39 Crania.)

The vertical contours are drawn from auricular points through zygomatic ridges vertically upwards over sagittal suture and down the opposite side. The tracings show the *norma facialis*, as do Benington's, whereas Morant's and Tildesley's show the *norma occipitalis*. The auricular points are joined to form the base line and ordinates drawn as shown in the diagram. The means from which the type contour

TABLE XVI.

Mean Values used in Plotting Vertical Type Contours.

Hylam Series (39 male Crania).

	Mean Value		Mean Value
MA	117·34	$7R$	70·37
$1R=1L$	55·30	$7L$	70·73
$M\frac{1}{4}R$	63·77	$8R$	65·70
$M\frac{1}{4}L$	63·82	$8L$	65·90
$2R$	65·51	$9R$	55·91
$2L$	66·03	$9L$	56·14
$3R$	69·22	$10R$	39·24
$3L$	69·56	$10L$	40·07
$4R$	72·10	$A\frac{1}{4}R$	18·09
$4L$	72·45	$A\frac{1}{4}L$	20·10
$5R$	73·18	$Z.R.\ R\ x$	4·25
$5L$	73·35	$Z.R.\ R\ y$	64·69
$6R$	72·44	$Z.R.\ L\ x$	4·93
$6L$	72·73	$Z.R.\ L\ y$	65·02

is constructed are given in Table XVI. Comparing the Hylam with his Chinese neighbour, the Hokien, we find that while the heights do not differ materially the sides of the contour bulge markedly in the Hylam. The amount of bulging is approximately 5 mm. on the right and 4 mm. on the left side. I mention these approximate values as Benington* constructed a type zone for his series of English skulls, the limits of the zone being marked at twice the probable error. In his English series the type zone is 1·4 mm. wide at the apex and 0·8 mm. near the auricular points. It is evident that, assuming the Hokien type zone to be approximately equal to the English series†, the Hylam contour would be outside the Hokien type zone. The interauricular breadth is only 0·7 mm. less in the Hylam than in the Hokien. Compared with Tibetan A we find that the Hylam is considerably wider and higher than the Tibetan A. Possibly my determination of the auricular point may differ from that of Morant and this may discount slightly the difference in height. The vertical contours show too wide a divergence, however, to be closely related. The Burmese A contour more closely resembles the Hylam than either Tibetan A or Hokien. The Hylam is undoubtedly wider

* "Cranial Type Contours," R. Crewdson Benington. *Biometrika*, Vol. VIII.

† [The English series being based on 100 crania, and the Hylam and Hokien on 39 and 36 respectively, the zones for the latter would need to be increased on those for the English in the ratio of 1 to 1·6 and 1 to 1·7 respectively.—Ed.]

than the Burmese but superimposing the zygomatic ridges which probably offer a better basis for comparison than the line joining the indeterminate auricular points, we find that the heights do not differ materially and would fall within the type zone. Superimposing the Hylam contour on the Tamil we find that the Tamil is contained entirely within the Hylam and the two types are outside the probability of relationship. The Hylam contour overlaps the Tamil by fully 8 mm. on each side. Comparing the Hylam with Tibetan B we find that the width between the zygomatic ridges is approximately equal, and when the zygomatic ridges are superimposed the two tracings have an equal height. The Hylam, however, widens out above the second ordinate, and at the seventh ordinate exceeds the Tibetan B by fully 5 mm. on either side, thereafter gradually narrowing down to the $A\frac{1}{4}$ ordinate where the two curves again meet. There is therefore a marked difference in shape of the two types of crania as judged from a comparison of their vertical contours.

9. *Weight of the Hylam Crania.* The mean weight of the Hylam crania is 621·7 gms. as compared with 656 gms. for the Hokien series and 575 gms. for the Tamil series. No deductions can be made from the weight of the skull as the range of variation is very great, the lowest value for the Hylam series being 402 gms. and the highest 865 gms. The heaviest skull is therefore more than double the weight of the lightest. Approximately the same variation obtains in the Hokien and Tamil series. The figures may tend to contradict the popular fallacy that the Chinese have an exceedingly thin paper-like skull, and in consequence are more liable to fractures of the skull than other races.

10. *Plane of the Foramen Magnum.* The plane of the Foramen Magnum relative to the Frankfurt horizontal in the Hylam series is 6°·15 which is practically the same as in the Hokien series which gives a value of 6°·0. The angle is not given for the Burmese A series but, measuring the angle on the sagittal type contour, I obtained a value of 6°·5. Tamil and Tibetan A are approximately the same at 8°·0 and 8°·3 respectively, the Tibetan B series giving the largest value at 12°·3.

11. *Résumé of the Comparative Facts.* While the Hylam apparently does not show any close affinity with the other Asiatic series compared, it resembles the Burmese A more than the others. The comparison of the vertical and sagittal type contours shows the closest approximations between these two series. Considering the values of the function $\frac{n_s n_{s'}}{n_s + n_{s'}} \left(\frac{M_s - M_{s'}}{\sigma_s}\right)^2$, out of 31 characters compared, 14 in the Burmese A fall within the range of common origin as specified by Morant*. Admittedly 17 characters in the Tibetan A series out of 31 fall within the range of common origin, but the divergence in some of the remaining characters is greater than in the Burmese A series. This is indicated in the C.R.L. based on the function which in the Burmese A gives a value of 9·27 for 31 characters as compared with 10·022 for Tibetan A for the same number of characters. As I have

* *Biometrika*, Vol. XIV. p. 212.

previously stated the C.R.L., based on angles and indices only, is according to the Biometric Laboratory a better indication of similarity in the shapes of different

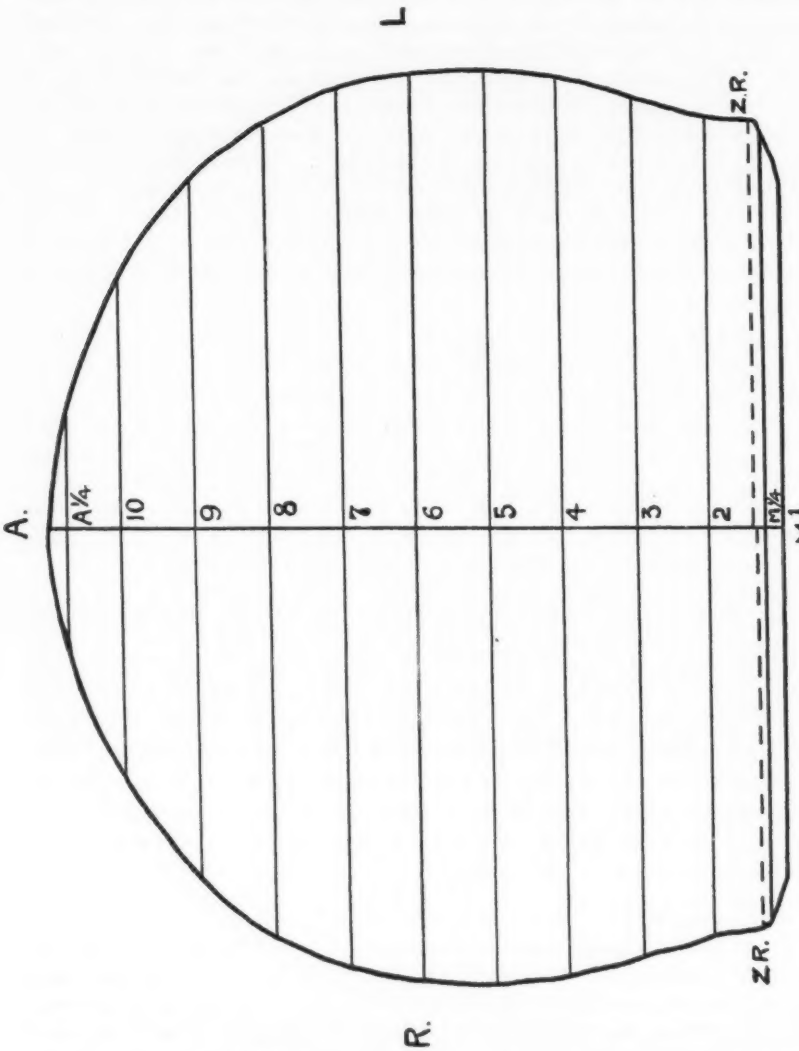

Fig. 2. Hylam Male Vertical Type Contour. (39 Crania.)

series than the C.R.L. for all characters. The C.R.L. for angles and indices only is 10·76 for Burmese A and 15·27 for Tibetan A for 12 characters. Judged by this criterion the Burmese A resembles the Hylam more closely in shape than does the Tibetan A,

and this fact is confirmed by the study of the type contours. This point is of particular interest in view of the statement in Tildesley's paper*, "after these conclusions had been arrived at upon the data themselves (i.e. the separation of the skulls into three groups) we put our doubt as to the collection being purely Burman before Col. Caster, and he reported that after further consideration there might be a certain number of Hindus† or of Karens in the material, but that it was unlikely, owing to the source from which it was drawn, to include any Chinese or any Mohammedans from India." The fact remains that the Hylam Chinese apparently resemble the Burmans more closely than any other Asiatics with which I have compared them. The Tibetan A approach more closely to the Hylam than do the Hokien Chinese. The C.R.L. of the Tibetan A is 10·022 compared with 18·429 in the Hokien for 31 characters and in the matter of shape, as judged by the C.R.L. for angles and indices only, the Tibetan A value is 15·718 as compared with the Hokien value of 30·021 for 12 characters. The comparison of the type contours confirms these facts. According to Morant's own opinion‡ the Tibetan A are a hybrid group and the series does not approximate sufficiently to Pearson's definition of a homogeneous series even admitting it to be hybrid§. If the series be heterogeneous it is possible that the impurity is one with characteristics resembling the Chinese which may account for the resemblance of the Tibetan A group, not only to the Hylam, but to the Hokien Chinese. The Tibetan B group is very small and heterogeneity is more marked than in the A group as indicated in the length factor giving the S.D. of 8·339. With a C.R.L. of 24·560 for 31 characters and 32·479 for angles and indices only, it is still further removed from the Hylam series than the Hokien is. The Tamil series cannot possibly have any racial affinity with the Hylam. There is no doubt that the Hylam, whatever he may have been at some remote period, is in modern times markedly divergent from the Hokien Chinese.

12. *Ethnological Notes.* The ethnology of the different peoples of China offers an intriguing and difficult problem for solution. When one remembers that China proper covers an area equal to seven times that of France, one does not expect to find a homogeneous population. Mountain chains almost surround and delimit the country, and in this land of rivers we find three great channels, the Yellow river, about 2500 miles long, in the northern part, the Yang-tsz-kiang, 3000 miles long, about the centre, and the Canton river to the south, which, with the mountains they drain, serve to divide the country into three large areas. China proper embraces the eighteen provinces and the Island of Hainan, the name meaning the island of

* "A First Study of the Burmese Skull." *Biometrika*, Vol. XIII. p. 218.

† As I pointed out in my previous paper, the term "Hindu" is exceedingly vague, and in this particular instance it is difficult to understand the sense in which it is applied. As Mohammedans from India are specifically mentioned, it would appear that the term is intended to convey the meaning "people of India professing the Hindu religion."

‡ "A First Study of the Tibetan Skull." *Biometrika*, Vol. XIV. p. 219.

§ [The term "hybrid" is used in the passage cited from Morant in the sense of a mixture of races, not of individual crossbreds. He refers to the racial mixtures to be found from Nepal to Tibet. As to Tibetan A exceeding the limits of homogeneity, see footnote p. 260.—ED.]

the South Sea. The southern and the middle areas of the country were inhabited by wild tribes which, in very remote times, had a common origin but through the ages diverged widely. These people were the so-called aborigines of China.

It seems highly probable from the present state of our ethnical knowledge that the earlier migrations started from the west and proceeded along the valleys, three great waves of migration occurring and commencing at different periods of time. Some five thousand or more years ago the country was occupied by the aboriginal tribes and the present Chinese race is supposed to have entered the country from the north-west and gradually but only partially succeeded in driving out the aborigines. Large areas in the south and south-west are still retained by the aborigines who have been successful in withstanding the Chinese and in the more inaccessible mountain heights have even compelled the Chinese to slave for them. Chinese records go back 4500 years and the first written records date back to 2254 B.C. Three prehistoric ages are described, the ages of wood, stone and metal implements, but of course these eras are valueless in setting an actual date, as there is no doubt that similar types of implements were in use in different parts of the world at different periods of time. Even as recently as 1200 B.C. the subdued aboriginal tribes of the south-western highlands paid tribute to the Imperial Government in flint weapons. From a consideration of the distribution of neighbouring primitive peoples I am inclined to think, though definite proof is wanting, that before the aborigines above mentioned occupied the land there were scattered tribes of the Negrito type approximating to the Sakai and Semangs of the Malay peninsular highlands in possession*.

A study of the information available suggests that three great waves of migration occurred in Asia, guided by the geographical arrangement of the country. Two of these waves, the southern and the midland, probably commenced about the same time, the northern wave commencing at a much later date and proceeding more slowly owing to the severe climatic conditions in the north. It would appear that the people of this latter wave had acquired some degree of culture before migrating and were later able to impose their culture on others with whom they came in contact, and by their greater knowledge were better fitted to dominate the more lowly cultured but better physically developed peoples. This northern wave of migration originated probably in Eastern Turkestan† north of the Nan Shan mountains and may have acquired the rudiments of its culture from Caucasian wanderers in this neighbourhood. The stream moved along the Hoang-Ho basin, one division trekking north following the sharp northerly deviation

* The island of Formosa was not known to the Chinese, who were not a seafaring race and did not venture far from their coast before, at the earliest, the 14th century A.D. The fact that Negritos are found on this island and the neighbouring Philippines seems to suggest that they occupied also the neighbouring mainland.

† Whence the people of ancient Tibet and Turkestan came has aroused considerable controversy. There is evidence to show that the ancient Chinese civilisation resembled the ancient Sumerian, Akkadian and Egyptian cultures in language, religion and astronomy. If this view be correct, then some district in the Euphrates valley saw the origin of these races.

of the river, the remainder moving south towards the present province of Shen Si. It has been suggested that a nomadic tribe in this province thousands of years B.C. was the nucleus of the present kingdom of China and probably the southern stream was arrested here for some considerable time due partly to the rich and fertile plains of this region and partly to the Pse Ling mountains and the difficult nature of the surrounding country generally. They settled in villages and became agriculturists and tradesmen, an indication of the influence of some culture, as rude uncultured peoples do not naturally take to agriculture. They became known as the Shen Si. Migration later spread along the tributaries of the Hoang-Ho and finally following the main stream and the southern estuary of the Delta, which has now disappeared, eventually reached the coast at the southern part of the province of Kiang-su. Gradually the country towards the south became occupied by these people but for many centuries China did not extend beyond the Yang-tsz-kiang, and this was possibly due to the war-like characteristics of the so-called aborigines on the south of the river, represented by the descendants of the middle wave of migration. Eventually, however, the Chinese proper, as represented by the peoples of the northern wave, drove the inhabitants of the region between the Yang-tsz-kiang and the Canton river towards the south and south-western highlands, while many were absorbed into the invaders from the north. The remainder of the people of the middle wave were gradually driven into the southern provinces and the south-eastern seaboard. The people of the southern provinces are mainly the Cantonese of to-day and are probably the most progressive people in China. The provinces in which the descendants of aboriginal tribes are found are Kwei Chou, Sz Chuen, Yun-nan, Kwang-tung, Kwang-si and the island of Hainan. In the island of Hainan are the aboriginal Le tribes who have maintained their independence against the Chinese for over two thousand years, being driven from the coast to the mountains of the interior. The Les are a well-developed and physically strong people, forming two divisions, one civilised and the other not, the "tame" and the "wild" Les, the latter living in the fastnesses of the great Five Finger Mountains. Some of the aborigines call themselves "Ki," and are said to be a much more fierce and violent people than the wild Les*. In marked contrast to the Chinese women, the Le women have the face and lower part of the body tattooed and wear skirts. There are many tribes of the Le people and the dialects of the different tribes are so varied that Hainanese, as this particular branch of the Chinese language is called, has become the lingua franca of the island in much the same way as Malay has become the lingua franca of the peoples of the Eastern Archipelago. The script of the Les shows no resemblance to the Chinese characters. It is estimated that the remnants of the so-called aboriginal tribes run to several millions in number and occupy territory equal to three times that of Great Britain in the provinces mentioned above. The Chinese who invaded the island of Hainan came from the area around Amoy and Swatow in the province of Fo-kien. They intermingled with the aborigines, and the resulting race is the Hylam branch of the Chinese people. There is

* "In the island of Hainan there are two groups of 'savages' or non-Chinese, one of which I personally ascertained to be of Shan kinship." *China*, by E. H. Parker. 1917, p. 9.

a popular belief that the island of Hainan was in early times used by the Chinese as a banishment island for undesirables, and the history of the Hakka people, who at one time were present in great numbers in the Fo-kien province, lends colour to the theory. Hainanese or Hylam, as it is locally known in the Straits, differs very greatly from Cantonese, but resembles somewhat the Swatow and Amoy and to a lesser extent the Hakka dialects. Alterations occur in the phonation of the words, e.g. the changing of "p" to "t" in the romanised script, but no greater changes than can be explained from an intermingling of two peoples of different language. It is a remarkable fact that such a large tract of territory as the province of Kwang-tung with its native dialect Cantonese should intervene between Hainan and the Fo-kien province. Cantonese is said to show traces of greatest antiquity of pronunciation among Chinese dialects* with a very considerable intermixture of adjacent tongues. All evidence points to the fact that the Cantonese are not pure Chinese in the ethnological sense, and it would therefore appear strange that this community should speak the purest form of the ancient Chinese language†. Ross, in his *Origin of the Chinese People*, gives the following explanation: The Manchus in the remote past inhabited Northern Manchuria and at the time when they invaded China they possessed a polysyllabic language reduced to writing by the application of Mongol characters, both Manchus and Mongolians having a common Turanian ancestry. They were a powerful people and took measures to make their language an official and a classical one. Every state document written in Chinese was duplicated in Manchu and carefully preserved in the archives. Yet in spite of great efforts to retain their own language, within two centuries of having conquered China, the Manchus had forgotten their national tongue and spoke only the monosyllabic language of the conquered Chinese.

The barbarians who occupied the land prior to the advent of the Chinese, necessarily occupied an inferior position to the Chinese, and as they settled down they instinctively adopted whatever means would most speedily obliterate all traces of their origin and assimilate them most completely to the Chinese. Just as the Manchus had serious reasons for retention of their distinctive language, these nomads had equally serious reasons to forget theirs. To remain isolated was the Manchu policy: to become absorbed in the main body of the Chinese was the policy of the nomads. Yet both were assimilated into the Chinese, the Manchus in an effort to retain their own language speaking a less pure form of the ancient Chinese than the nomads whose object was to simulate the Chinese to the uttermost.

* "The Cantonese dialect is far and a long way the highest in development and corresponds most closely with the theoretical or dictionary form of ancient times. This is the more remarkable in that the Cantonese people are not of pure 'old China' stock." *China*, by E. H. Parker. 1917, p. 361.

† Dr Lim Boon Keng has pointed out to me that the district presently occupied by the Cantonese was the first to be opened up by the Chinese proper, and the Cantonese pronunciation is the pronunciation of the period when the language was introduced into the district, perpetuated to the present day. The pronunciation of the language in the north became modified with the passage of time and the pronunciation of the ruling people, the north having always been disputed territory sometimes ruled by Tibetans, sometimes by Tungs, Manchus or others. About five centuries after Chinese was introduced into Canton, the Chinese opened up the present Fo-kien province, and the Fo-kien dialect of to-day retains practically the pronunciation of the language as it was introduced into the district.

The Hakka people are called "Kheks" in the Straits, this being the Amoy and Swatow pronunciation of the word "Hak," which means a "stranger"*. While I have not been able to procure samples of Khek crania, yet from observations on the living they appear to be not unlike the Hylam. It should be distinctly understood that not all the peoples of the Canton provinces speak Cantonese. In the Kwang-tung province alone, one-third of the people amounting to, it is estimated, six millions speak the Hakka dialect. The Hakkas are to be found in colonies over large areas of the country, and the variations of the sub-dialects are not so marked as the variations of the Cantonese sub-dialects. The Hakkas were originally a North China people, where at least in the third century B.C. they occupied the Shan-tung peninsula. During the persecutions of the Ts'in dynasty from B.C. 249—209 and again in A.D. 419 the Hakkas were driven south, and while very considerable interminglings must have occurred, their language has been retained as pure as any dialect in China. Eventually the majority were forced to the mountains of Fo-kien, and the mountains on the border of Kwang-si and Kwang-tung provinces. About A.D. 1368, owing to further disturbances, the Fo-kien Hakkas were forced to leave and, migrating in great numbers, they passed over into the Ka-ying-chau prefecture, which has remained their headquarters up to the present day. About the middle of last century serious disturbances occurred between the Cantonese and the Hakkas in the Canton provinces, and eventually the government took strong measures to quell the disturbances and provided money to assist the Hakkas to migrate to waste lands chiefly in the province of Kwang-si and the island of Hainan. There is a large colony of Hakkas in the interior of Hainan in close association with the Le people. The Hakkas were known as the "old" and the "new" Hakkas, the old Hakkas being a more peaceable people and having resided on the island for many centuries. The new Hakkas were recent immigrants from Canton and were, generally speaking, a wild and lawless folk, raiding villages and stealing cattle both from the Les and the Chinese. Eventually the government sent a punitive expedition with instructions to kill or capture all "new" Hakkas, but to leave the "old" Hakkas unmolested. There was a great slaughter of "new" Hakkas, although some escaped to the mountains and banded themselves permanently with the wild Les. The Les as a people are kindly and courteous, but greatly distrust (and with good reason) the Chinese, who have mercilessly exploited them. It is interesting to note that the Hakkas do not practise feet-binding, probably as a result of the compulsory wanderings of this much persecuted group of people. The Hakkas are said to be a very tenacious and contentious people.

The southern wave of migration commenced from the Shan states on the Burmese borderland. Here again it is probable that the Shan states in the wooded valleys of Burmah proved a veritable garden to the wandering people and became a resting place for some considerable time, the original home of this group of

* The proper interpretation of the word "Hak" is "guest," the term being used by the Chinese as a polite reference to a person from a distance, not belonging to the same province. The Chinese are too inherently polite to use the word meaning "stranger," which might imply disrespect.

people being on the Tibetan plains. The "Wanderlust" again dominating, the people spread eastwards, some branching off to the south into Siam and the remainder continuing east towards the sea through the state of Tonquin and probably reaching the Gulf of Tonquin between the southern end of the Yu-ling mountains and the coastal range of Annam. Having reached the sea, they spread along the coast to the Lien Chow peninsula and thence to the neighbouring island of Hainan, which at this remote period was probably directly connected to the mainland. The term "Shan" appears to be the Burmese form for the Siamese "Lao." It is a point of very considerable interest that the Siamese group the Lao people into two—the "Lao-pang-dun" meaning "black paunch Lao," so called because they tattoo the lower part of the body and thighs, and the "Lang-pang-kah" or "white paunch Lao," who do not tattoo. It is significant that the womenfolk of the aboriginal Les of Hainan tattoo the lower part of the body. Another link in the chain of evidence is added by the fact that some of the Les call themselves "Moi," while some of the aborigines of Cochin China are also called "Moi." The Burmese group call themselves "Ngiou," the common Chinese equivalent being "Paï," which Prince Henry of Orleans points out is merely another name for Lao. Carl Bock notes that the Ngiou are decidedly of the same race as the Burmese: "I have had opportunities of seeing hundreds of both countries and of closely watching their features and build. The Ngiou wear their hair in a top knot in the same way as the Burmese but are easily distinguishable by their tattooing which is much more elaborate." "Of course all spring from one primeval stock but they now constitute distinct ethnical groups and, except about the borderlands where blends may be suspected, both the physical and mental characters differ considerably*." Prince Henry in the course of his journey constantly met Paï groups all along the route from Tonquin to Assam, and the bulk of the lowland population of Assam originally belonged to the Laos, though now assimilated into the neighbouring Indian speech, religion and general culture.

The middle wave, I consider, originated in the Tibetan plains and moved along the valley of the Yang-tsz-kiang. The stream of emigrants was apparently diverted into two channels, one passing southwards along the Canton river valley and one moving more easterly towards the present provinces of Fo-kien, Che-kiang and Kwang-su, the latter mingling with the people of the northern wave when the latter arrived along the coast of the Yellow Sea. It is highly probable, as I have already stated, that the Shan people and the people of the middle wave had a common origin on the Tibetan plains. The racial characteristics of the Shans on the Burmese borderlands, the Siamese and the Annamese suggest only a remote affinity with the Cantonese. The present state of our ethnical knowledge indicates that there is some racial affinity between the Cantonese and the Shans, though I cannot accept the theory that the Cantonese are a Shan people but rather believe that both had a common ancestor. I am of the opinion that the so-called aborigines of China between the Canton river and the Yang-tsz-kiang migrated

* Quoted direct from *Man, Past and Present*, by A. H. Keane.

from the Tibetan plains, while the region to the south of the Canton river was inhabited by aborigines of the Shan country*.

The Hylam people are obviously not a pure race, although the interminglings which have occurred were between peoples of Mongol origin. The Hylam Chinese are the product of the blending of Chinese proper from the northern provinces with the aboriginal Les, whose affinities are with the Shans. There is an interesting legend in connection with the origin of the Le people which is very suggestive. "To the west of the city of King-chow-fu there formerly stood the Le Mother Temple. Tradition relates that the Spirit of Thunder carried an egg into the mountains from which a woman was produced, and further, that a man from Kau-chi (Annam) crossed the sea in search of fragrant herbs and that on the marriage of these two, children and grand-children followed in great numbers. This was the Le mother who is also called their Patron Saint (?) and the first female ancestor of the Le people, so it is said†." As the Burmese, although now modified by intermingling with Aryan elements from India, are a branch of the Shan peoples one can readily understand the racial resemblance of the Hylams to the Burmese.

Perhaps the most remarkable feature of the Hylam head in the living subject is the marked flattening of the occipital region, the back of the head making a straight line with the back of the neck. Mr W. G. Stirling, of the Chinese Protectorate, Singapore, has suggested to me that the flattening is unintentionally produced in infancy. The Hylam people are a very poor people, and when the mother goes out to work in the morning the infant is tied down on its back in a wicker cradle, and may remain in that position the greater part of the day. While this factor may have some effect in producing the flattening, it is not the whole explanation as the flattening appears even in the younger members of families where the older children have acted as nurses.

In conclusion I have to thank Dr Lim Boon Keng, O.B.E., Principal of the Amoy University, the well-known Chinese scholar and littérateur, whose knowledge of the Chinese and Chinese history is unrivalled, for kindly reading over my ethnological notes. My thanks are due also to Mr W. G. Stirling, of the Chinese Protectorate, Singapore, an admitted authority on Chinese affairs, for suggestions in the preparation of the notes, and to the books *Things Chinese* by J. Dyer Ball, and *Man, Past and Present* by A. H. Keane, from which I obtained much valuable information. I append the names of a few other books which I have perused in quest of information.

* "Of the south-west barbarians taken as a whole, I am disposed to think that in all probability most of them will be found to range themselves under the 'Shan' or the 'Tibetan' head." *China*, by E. H. Parker. 1917, p. 10.

† Quoted by B. C. Henry in his book *Ling Nam*, from the Chinese work entitled *Fresh Notices of Kwang-tung*.

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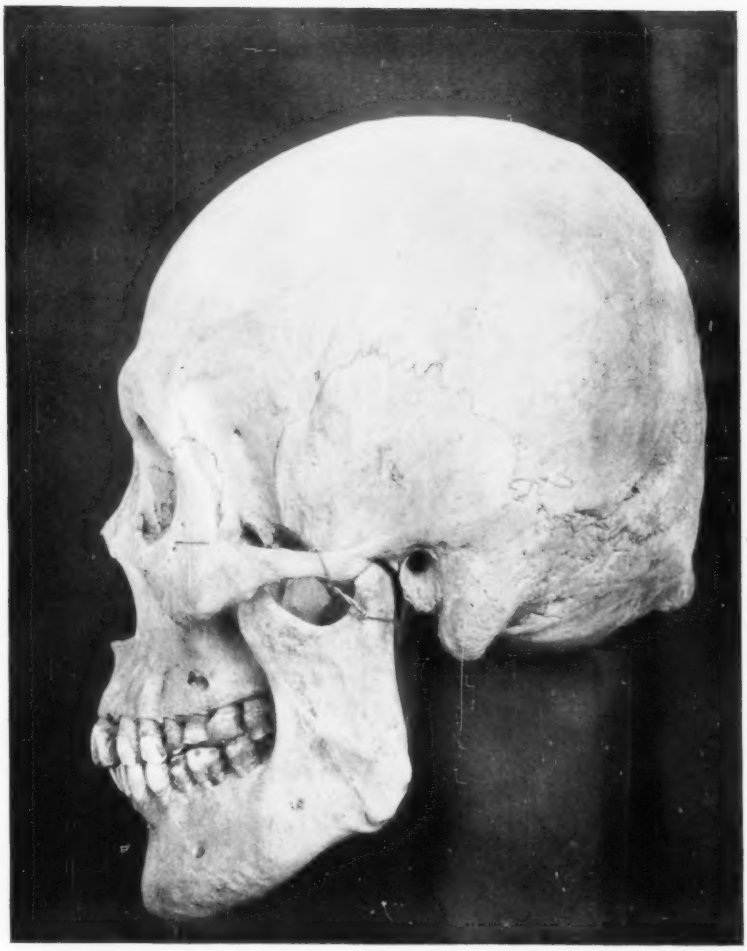
PLATES.

Plate I. *Norma lateralis* of the Hylam Male Skull (No. 127 of series).
Plate II. *Norma facialis* ,, ,, ,,
Plate III. *Norma verticalis* ,, ,, ,,
Plate IV. *Norma occipitalis* ,, ,, ,,

Final Editorial Note to Professor Harrower's Paper.

I think some explanation of the apparent divergence of opinion between Professor Harrower and Dr Morant may be found in their uses of the word *Chinese*. Professor Harrower is using it in the sense of a group living geographically within the Chinese Empire. The biometricians are using the word in an ethnographic sense. The children of Polish Jews born in London are geographically and politically British citizens, but racially they are not English, and can only be described as Polish Jews. When Professor Harrower spoke of the Hylam *Chinese*, the ethnographer naturally supposed them to be *racially* Chinese, while Professor Harrower merely meant that they are geographically inhabitants of the Chinese Empire. To a biometrician any groups showing a Coefficient of Racial Likeness above 30 for Indices and Angles must be racially differentiated, and incapable of bearing the same ethnographic name. Professor Harrower's Hylams differ racially from the Chinese in all four series of the latter that have been worked out, more than Tibetans A do from the English, or indeed more than the Southern Chinese do from the English. When therefore Professor Harrower speaks of Hylam Chinese, he is using the term I venture to think in the same sense as when we speak of Chinese British subjects in Hongkong as Chinese English, i.e. as Chinese dwelling in the British Empire. The Hylams are not a subrace of the Chinese, but as distinct ethnographically from them as the English are from the Chinese. The table on the following page illustrates these racial differences by aid of C.R.L. analysis.

The four square of the right bottom corner of this table (F—I and F'—I') indicates how close are all the Chinese series to each other. It is only Koganei's series of Northern Chinese that shows less association, but not beyond what we expect for local groups of the same race. Turning to row A (or column A') of the table we see the contrast of a European race (English) with the Oriental races, but the English are nearer to the Tibetan A and the Chinese than they are to the Burmese. Again the separation of the Hylam from the Chinese is marked; they are nearly three times as remote from the English as the Chinese are. In order to indicate that the same result is not true for all European races, we have cited some values for the Serbo-Croats. This European race, while far removed from the English (AB'), is nearer to the Hylam (CB') than the Chinese are. The



Hylam Male Skull, No. 127. *Norma lateralis* (Left Profile).

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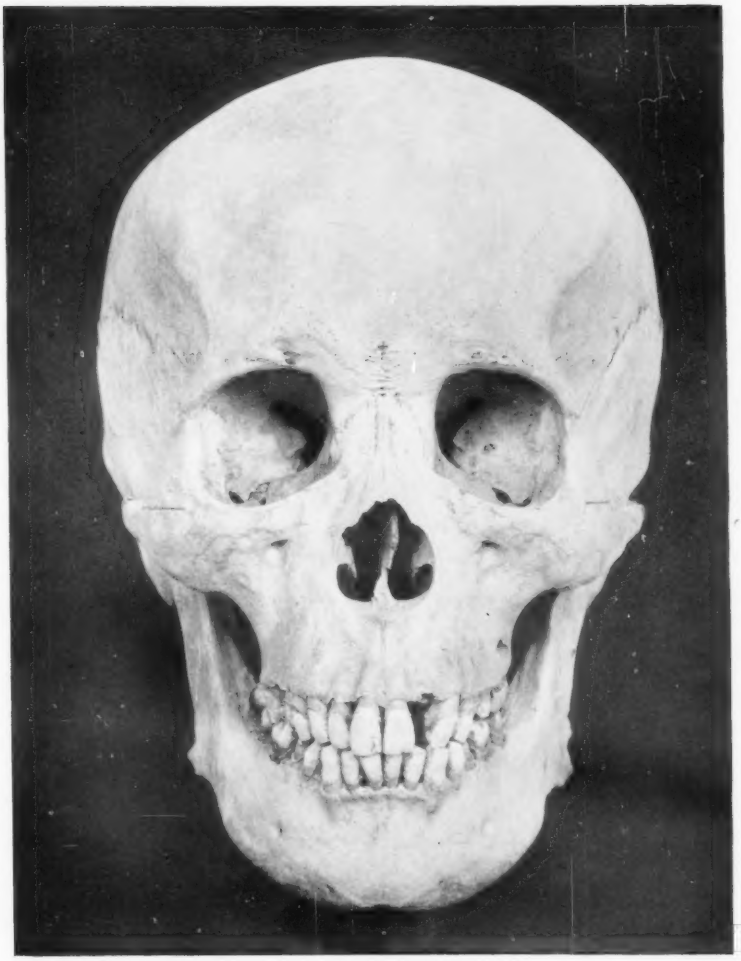
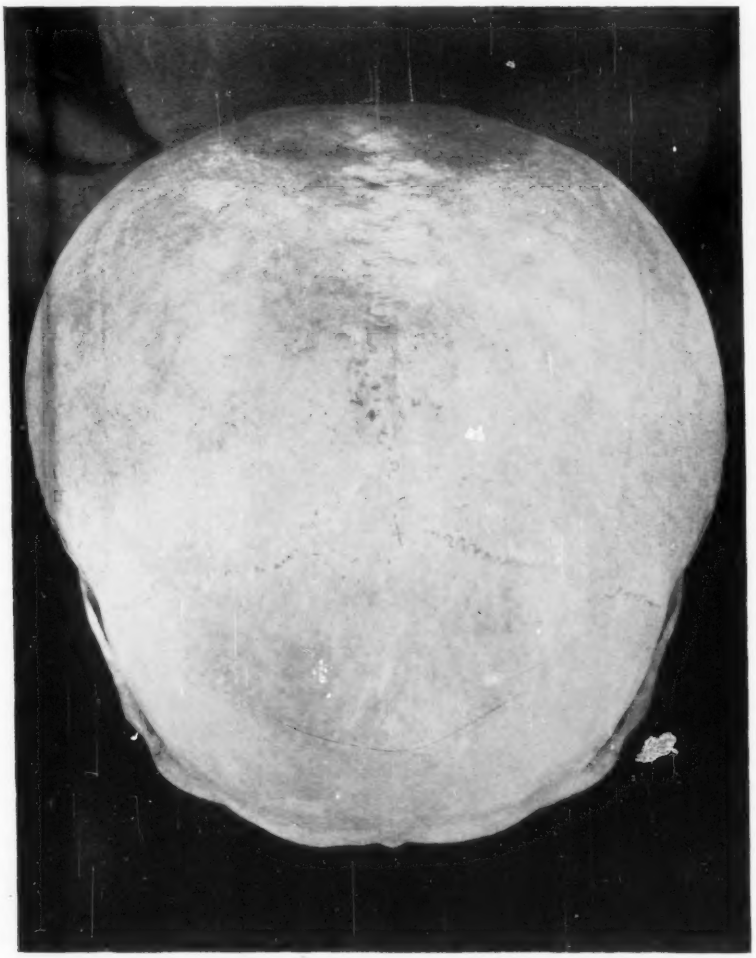
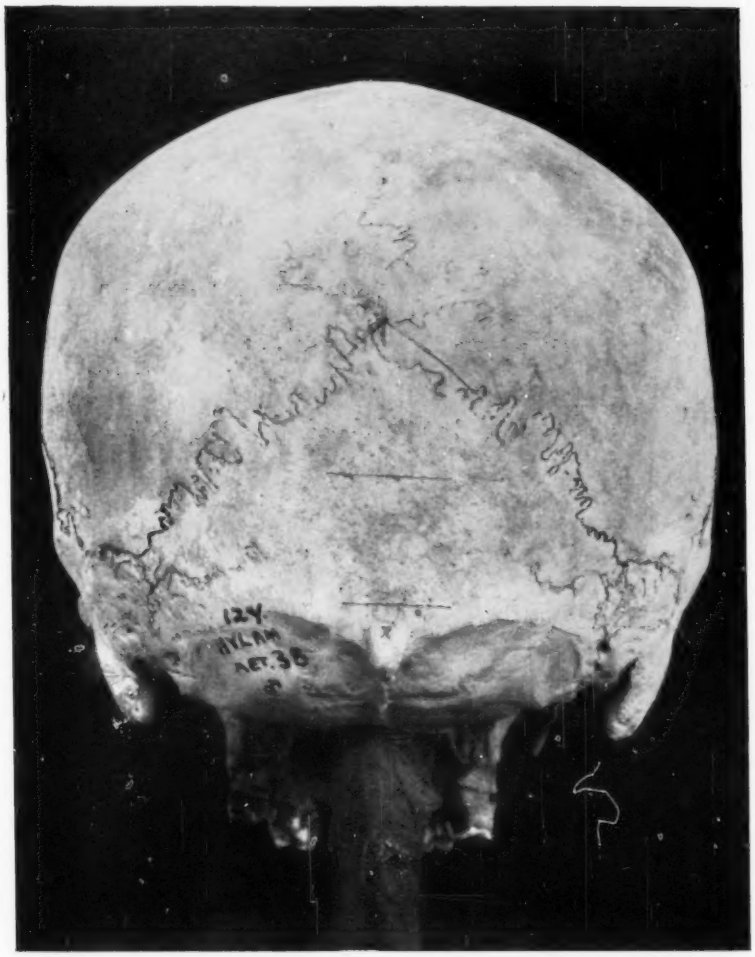


Hylam Male Skull, No. 127. *Norma facialis.*



Hylam Male Skull, No. 127. *Norma verticalis.*



Hylam Male Skull, No. 127. *Norma occipitalis.*

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Coefficients of Racial Likeness to illustrate Professor Harrower's Hylam Cranic and their Relationship to other Racial Types.

Racial Groups

Coefficients of Racial Likeness to illustrate Professor Harrower's Hylam Cranic and their Relationship to other Racial Types.

Racial Groups.

		English [Hooke & Macdonell] (95·4)	Serbo-Croats [Weisbach] (79·8)	Hylam [Harrower] (39·0)	Burmese A [Tildesley] (41·0)	Tibetan A [Morant] (35·9)	Southern Chinese [Various] (52·5)	Hokien Chinese [Harrower] (36·0)	Northern Chinese [Various] (36·4)	Northern Chinese [Koganei] (69·4)	
English [Hooke & Macdonell]	α	—	53·03 ± ·19 {25}	74·10 ± ·17 {31}	45·68 ± ·18 {27}	22·69 ± ·18 {27}	20·03 ± ·19 {25}	26·16 ± ·17 {29}	29·31 ± ·17 {29}	28·21 ± ·20 {21}	
	β	—	—	117·39 ± ·26 {12}	51·64 ± ·29 {10}	17·81 ± ·29 {10}	21·99 ± ·30 {9}	35·62 ± ·27 {11}	37·08 ± ·27 {11}	22·21 ± ·36 {6}	*A*
	γ	—	—	7·17 ± ·24 {15} *	—	—	—	—	—	—	
			*	*							
Serbo-Croats [Weisbach]	α	53·03 ± ·19 {25}	—	17·14 ± ·19 {25}	—	—	—	—	—	—	
	β	—	—	23·04 ± ·29 {10}	—	—	—	—	—	—	*B*
	γ	* —	—	14·38 ± ·27 {11}	—	—	—	—	—	—	
Hylam [Harrower]	α	74·10 ± ·17 {31}	17·14 ± ·19 {25}	—	9·27 ± ·17 {31}	10·02 ± ·17 {31}	25·66 ± ·18 {27}	18·43 ± ·17 {31}	20·50 ± ·17 {31}	35·97 ± ·21 {19}	
	β	117·39 ± ·26 {12}	23·04 ± ·29 {10}	—	10·76 ± ·26 {12}	15·72 ± ·26 {12}	46·43 ± ·29 {10}	30·02 ± ·26 {12}	34·79 ± ·26 {12}	91·55 ± ·41 {4!}	*C*
	γ	7·17 ± ·24 {15} *	14·38 ± ·27 {11}	—	8·54 ± ·24 {15}	2·49 ± ·24 {15} ‡	0·50 ± ·27 {11}	3·22 ± ·24 {15}	3·13 ± ·24 {15}	8·26 ± ·33 {7}	
Burmese A [Tildesley]	α	45·68 ± ·18 {27}	—	9·27 ± ·17 {31}	—	10·09 ± ·17 {31}	6·24 ± ·17 {31}	9·34 ± ·17 {31}	10·18 ± ·17 {31}	19·62 ± ·19 {25}	
	β	51·64 ± ·29 {10}	—	10·76 ± ·26 {12}	—	7·73 ± ·26 {12}	4·77 ± ·26 {12}	11·36 ± ·26 {12}	15·16 ± ·26 {12}	34·30 ± ·32 {8}	*D*
	γ	—	—	8·54 ± ·24 {15}	—	—	—	9·51 ± ·24 {15} †	—	—	
Tibetan A [Morant]	α	22·69 ± ·18 {27}	—	10·02 ± ·17 {31}	10·09 ± ·17 {31}	—	5·50 ± ·17 {31}	7·26 ± ·17 {29}	8·01 ± ·17 {31}	20·40 ± ·19 {25}	
	β	17·81 ± ·29 {10}	—	15·72 ± ·26 {12}	7·73 ± ·26 {12}	—	2·66 ± ·26 {12}	4·97 ± ·27 {11}	9·48 ± ·26 {12}	17·83 ± ·32 {8}	*E*
	γ	—	—	2·49 ± ·24 {15} ‡	—	—	—	5·74 ± ·25 {13}	—	—	
Southern Chinese [Various]	α	20·03 ± ·19 {25}	—	25·66 ± ·18 {27}	6·24 ± ·17 {31}	5·50 ± ·17 {31}	—	1·76 ± ·18 {27}	0·59 ± ·17 {31}	6·15 ± ·19 {25}	
	β	21·99 ± ·30 {9}	—	46·43 ± ·29 {10}	4·77 ± ·26 {12}	2·66 ± ·26 {12}	—	1·24 ± ·29 {10}	1·00 ± ·26 {12}	5·45 ± ·32 {8}	*F*
	γ	—	—	0·50 ± ·27 {11}	—	—	—	—	—	—	
Hokien Chinese [Harrower]	α	26·16 ± ·17 {29}	—	18·43 ± ·17 {31}	9·34 ± ·17 {31}	7·26 ± ·17 {29}	1·76 ± ·18 {27}	—	1·62 ± ·17 {31}	1·54 ± ·21 {19}	
	β	35·62 ± ·27 {11}	—	30·02 ± ·26 {12}	11·36 ± ·26 {12}	4·97 ± ·27 {11}	1·24 ± ·29 {10}	—	2·10 ± ·26 {12}	0·35 ± ·41 {4!}	*G*
	γ	—	—	3·22 ± ·24 {15}	9·51 ± ·24 {15} †	5·74 ± ·25 {13}	—	—	—	—	
Northern Chinese [Various]	α	29·31 ± ·17 {29}	—	20·50 ± ·17 {31}	10·18 ± ·17 {31}	8·01 ± ·17 {31}	0·59 ± ·17 {31}	1·62 ± ·17 {31}	—	2·56 ± ·19 {24}	
	β	37·08 ± ·27 {11}	—	34·79 ± ·26 {12}	15·16 ± ·26 {12}	9·48 ± ·26 {12}	1·00 ± ·26 {12}	2·10 ± ·26 {12}	—	1·58 ± ·33 {7}	*H*
	γ	—	—	3·13 ± ·24 {15}	—	—	—	—	—	—	
Northern Chinese [Koganei]	α	28·21 ± ·20 {21}	—	35·97 ± ·21 {19}	19·62 ± ·19 {25}	20·40 ± ·19 {25}	6·15 ± ·19 {25}	1·54 ± ·21 {19}	2·56 ± ·19 {24}	—	
	β	22·21 ± ·36 {6}	—	91·55 ± ·41 {4!}	34·30 ± ·32 {8}	17·83 ± ·32 {8}	5·45 ± ·32 {8}	0·35 ± ·41 {4!}	1·58 ± ·33 {7}	—	*I*
	γ	—	—	8·26 ± ·33 {7}	—	—	—	—	—	—	
		A′	*B′*	*C′*	*D′*	*E′*	*F′*	*G′*	*H′*	*I′*	

The numbers in round brackets denote the average number of crania for each racial group that were available in computing the coefficients. The numbers in curled brackets denote the number of characters used in each individual case.

α denotes the C.R.L. for All Characters; β, the C.R.L. for Indices and Angles; γ, the C.R.L. for Facial and Palatal Measurements only.

The probable errors due merely to random sampling have been computed from the *full* formula: $\text{P.E.} = \cdot 67449 \sqrt{\frac{2}{m}} \sqrt{1 - \frac{1}{m}}$.

* All the Coefficients of Racial Likeness for English are worked out from the 17th century skulls of Macdonell, except those in the compartments marked with an asterisk, which are from skulls of the same date measured by Hooke.

† These values differ from those provided by Professor Harrower on p. 587 of his "Study of the Hokien and the Tamil Skull" (*Trans. R. S. Edinburgh*, Vol. LIV. 1926), because corresponding values of the orbital width are here taken.

‡ These values differ from Professor Harrower's because the *fuller* series of Tibetan A crania (*Biometrika*, Vol. XVI. pp. 27—28) has been used.

Hylams, while relatively near to Burmese (*CD'*) and Tibetans (*CE'*), are farther removed from the *Chinese* proper than from certain European races.

The Burmese A, as we have now their coefficients, are as Professor Harrower has indicated near to his Hylams (*CD'*), but they are nearer to the Southern Chinese (*DF'*), with increasing differences as we pass northward, culminating with Koganei's somewhat exceptional Northern Chinese (*DI'*), the latter being also, of all the oriental groups, most remote from Tibetan A (*EI'*).

I think these numbers provide evidence enough to indicate that the Hylam are, as Professor Harrower states, widely divergent from the Hokien, or indeed from any other Chinese series yet dealt with; they are indeed as far removed—it may be in other directions—as the English are from the Chinese. But it is just because this divergence is so great, that we feel justified in questioning whether they ought to be called Hylam *Chinese*. It may be correct in a geographical, it is not so in a racial sense.

There is in this matter only one critical point to be noted: Do the Hylam deform their skulls by the habit of strapping their babies to boards? There has been what may perhaps be described as something more than a rumour to the effect that they do. To throw some light on this point, the Coefficients of Racial Likeness with the Hylam were taken out for Facial and Palatal measurements only. The results given in row *C* are very striking. The Hylam are now within the range of random sampling *identical* with the Southern Chinese, and within the range of local groups of the same race strikingly close to all the Chinese. This might seem a strong argument in favour of distortion. I will not say that it is not; but more coefficients must yet be worked out for a variety of races. It may be a general principle that all races are actually more alike in their facial than in their calvarial characters, although we are very apt to suppose that physiognomy is the chief basis of our racial discrimination. Should this turn out to be the fact, we might have to conclude that the facial skeleton on which the organs of external sensory perception depend has been earlier established and fixed, than the shape of the brain which determines the shape of the calvarium. In other words evolution has developed racial differences in man rather by brain selection than by selection of the receptive part of the sensory organs. This is merely a suggestion, but one which does justify a fuller discussion of C.R.L.'s for Facial and Palatal measurements only, and this in itself may require more numerous and varied facial measurements than have hitherto been provided. In the same manner when the mandibles of an adequate number of races have been measured, C.R.L.'s confined to mandibular measurements only may possibly throw light on the influence of diet, which some authorities have supposed to be largely influential in shaping chin and jaws.

I have to thank Dr Morant for most kindly providing me with many C.R.L.'s, partly from his manuscript records, partly by fresh calculation, and partly by revision of earlier results. It is only by a table such as the present, which is so largely the result of his work, that one can fully estimate the value of the Coefficient of Racial Likeness in discriminating racial differences. It is not a perfect instrument, but I believe it the best we have at present.—ED.

Specimen No.	85	89	91	93	94	95	96	97	98	100	102	103	104
Age	24	25	37	33	37	39	55	36	25	53	56	40	26
Capacity	1220	1480	1580	1380	1470	1440	1535	1160	1360	1690	1320	1365	1465
Weight	445	525	650	640	600	605	865	533	475	628	708	627	805
Characters													
Lengths:													
Glabellar-Occipital	159·5	169·5	166·5	165·5	168·0	165·0	172·0	164·5	164·0	176·0	159·0	175·0	176·5
Opisthio-Nasal ...	124·5	128·6	131·2	135·0	127·3	133·0	133·0	125·3	132·0	137·2	128·3	131·0	136·0
Basi-Nasal ...	86·0	98·5	95·0	102·0	93·4	98·2	99·3	91·2	101·0	101·2	96·1	98·0	100·5
Basi-Prosthion* ...	81·0	96·6	94·0	107·0	88·5	94·0	97·8	92·0	97·2	103·0	93·0	102·3	97·0
Nasi-Alveolar* ...	56·5	70·6	68·3	75·6	78·5	75·8	72·5	67·9	67·6	76·0	72·0	71·8	72·2
Breadths:													
Max. Parietal ...	139·0	141·0	150·5	149·0	147·0	149·5	161·0	136·5	143·0	154·5	148·5	141·0	143·3
Min. Frontal ...	89·2	91·0	99·5	91·2	93·5	89·6	94·1	90·0	88·5	94·7	94·6	85·2	98·6
Interzygomatic ...	121·5	128·8	135·5	140·0	130·7	139·5	144·0	131·0	134·2	139·0	132·0	128·0	129·9
Face	96·0	102·3	99·1	106·6	104·5	105·5	103·6	94·3	99·0	111·9	97·1	101·0	103·5
Interauricular ...	98·0	105·4	113·0	114·8	115·8	119·0	122·0	107·2	112·4	116·0	106·0	104·0	111·0
Heights:													
Basibregmatic ...	128·5	140·2	146·3	131·8	135·5	128·8	140·0	126·6	135·2	142·5	134·2	137·0	142·5
Auricular ...	114·0	120·5	126·0	117·5	116·5	113·0	121·5	109·2	114·0	124·5	117·7	119·0	122·5
Angles in degrees:													
$N\angle$	65·4	67·4	67·2	72·9	61·7	64·1	67·3	68·8	66·6	69·6	65·2	72·0	65·4
$A\angle$	75·4	70·2	70·3	65·1	67·3	69·4	69·8	67·4	74·6	67·0	70·5	66·2	71·6
$B\angle$	39·2	42·4	42·5	42·0	51·0	46·5	42·9	43·8	38·8	43·4	44·3	41·8	43·0
$P\angle$	85·0	84·9	82·5	80·0	86·0	85·2	84·1	81·9	85·5	82·4	86·0	79·0	87·5
$\theta_1\angle$	29·6	27·7	30·3	27·1	32·3	30·7	28·6	29·3	27·9	28·0	28·8	29·0	27·1
$\theta_2\angle$	9·6	14·7	12·2	14·9	18·7	15·8	14·3	14·5	10·9	15·4	15·5	12·8	15·9
fm. $\angle$	6·2	4·0	5·8	6·0	5·7	8·8	3·3	12·0	1·5	14·3	5·0	5·5	4·2
Arcs:													
Sagittal	339	365	371	343	363	342	368	340	344	379	347	371	378
Frontal	118	128	132	112	128	118	135	125	121	122	120	127	125
Parietal	121	130	139	123·5	126	114·5	116	116·5	116	134	125	127	139
Occipital	100	107	100	107·5	109	109·5	117	98·5	107	123	102	117	114
Transverse ...	311	327	344	333	334	324	350	303	313·5	350	332	322	331
Chords:													
Frontal	99·5	114·4	117·2	105·3	116·4	107·0	118·8	107·0	106·9	105·7	105·5	112·5	109·8
Occipital	88·5	94·2	91·0	92·2	95·0	99·8	101·5	84·0	91·0	106·2	90·0	98·6	101·2
Circumference:													
Horizontal ...	470·5	490·0	545·0	494·0	501·5	498·5	517·0	477·5	489·0	524·0	486·0	498·5	506·5
Diameter:													
Asterionic ...	96·0	100·0	106·8	112·4	102·5	112·1	113·0	94·0	103·0	107·0	109·2	106·6	102·4
Nose:													
Height	43·7	48·9	48·0	52·7	53·5	56·0	51·4	50·7	49·9	55·0	55·6	51·0	49·2
Breadth	21·5	25·0	26·0	26·8	24·8	25·6	25·2	29·4	24·4	27·2	25·2	25·2	24·3
Orbits:													
Height, Right ...	33·7	36·0	34·5	35·2	34·4	38·9	36·1	32·9	34·1	33·3	32·5	33·0	29·5
" Left ...	33·7	36·0	34·2	36·7	36·0	39·0	37·0	34·5	34·0	34·4	34·0	33·0	29·9
Breadth, Right ...	36·4	37·6	40·0	40·8	39·5	40·1	40·9	39·5	38·0	42·1	36·6	38·8	37·9
" Left ...	35·5	37·6	38·6	39·8	39·5	40·3	39·8	39·9	38·0	41·4	35·8	38·0	37·2
Palate:													
Length	42·0	49·0	48·0	55·0	48·5	47·0	50·0	48·5	47·0	52·0	49·0	55·0	48·5
Breadth	38·0	36·5	37·0	36·5	37·0	33·5	40·0	40·5	38·0	43·0	36·5	36·0	44·0
Foramen Magnum:													
Length	40·6	32·7	38·8	35·0	36·7	36·0	36·0	35·0	33·8	36·7	34·3	34·9	37·0
Breadth	32·3	29·0	32·4	28·8	30·8	34·9	31·0	28·0	29·4	30·5	28·4	28·4	29·9
Indices:													
Breadth	87·15	83·19	90·33	90·03	87·50	90·60	93·60	82·98	87·19	87·78	93·39	80·57	81·19
Height	80·56	82·72	87·87	79·03	80·66	78·06	81·39	76·89	82·50	80·97	84·40	78·29	80·74
Breadth-Height ...	108·17	100·56	102·87	113·05	108·64	116·08	115·00	107·82	105·77	108·42	110·65	102·99	100·56
Facial	58·85	69·01	68·92	70·92	75·12	71·85	69·98	71·00	68·29	67·92	74·15	71·09	69·76
Gnathic	94·19	98·07	98·95	104·90	94·75	95·72	97·48	100·88	96·24	101·78	96·77	104·39	96·62
Frontal	61·13	70·04	68·71	88·56	74·74	73·68	67·02	62·97	67·67	64·48	66·86	68·18	66·71
Occipital	68·01	67·02	74·74	63·08	65·40	75·30	64·61	62·35	62·05	63·99	67·50	61·05	68·71
Nasal	49·19	51·12	54·18	50·85	46·35	45·71	49·03	57·99	49·39	49·45	45·33	49·41	49·39
Orbital, Right ...	92·58	95·74	86·25	86·27	87·09	97·01	88·26	83·29	89·74	79·09	88·79	85·01	77·84
" Left ...	94·93	95·74	88·60	92·21	91·14	96·77	92·97	86·46	89·48	83·09	94·97	85·01	80·29
Palatal	90·48	74·49	77·08	66·36	76·29	71·28	80·00	83·51	80·85	82·69	74·49	65·45	90·72
Foramen Magnum ...	79·56	88·69	83·51	82·03	83·92	96·94	86·11	80·00	86·98	83·11	82·79	81·38	80·81

* See footnote, p. 263.

APPENDIX.

Table of Individual Measurements of Hylam Male Crania.

103	104	105	108	110	112	113	114	115	116	117	118	119	120	121	124	
40	26	20	29	40	24	26	32	40	23	60	44	26	30	44	25	
1365	1465	1410	1365	1460	1415	1390	1715	1565	1380	1535	1380	1530	1415	1400	1560	
627	805	465	620	675	635	513	735	815	588	753	687	635	853	663	586	
75·0	176·5	167·5	165·3	165·5	163·7	168·0	174·5	174·0	172·3	173·2	175·5	167·0	167·5	169·0	166·0	1
31·0	136·0	120·0	130·2	129·5	131·2	130·3	139·5	136·0	132·4	138·0	132·0	132·0	128·1	128·1	128·4	1
98·0	100·5	86·9	96·0	96·1	96·0	95·0	102·2	101·0	97·8	99·0	101·2	100·0	96·0	96·0	94·6	
92·3	97·0	82·4	90·0	91·0	88·0	96·1	101·7	96·8	101·1	90·5	100·0	86·4	97·5	88·0	91·2	
71·8	72·2	70·0	70·5	63·5	68·6	71·0	75·8	70·7	71·6	73·2	67·5	78·8	72·5	74·2	71·6	
41·0	143·3	143·5	140·5	157·0	152·2	140·0	156·0	155·0	153·2	148·4	140·5	159·0	154·0	142·0	147·0	1
35·2	98·6	90·0	93·0	100·1	85·7	90·0	102·0	98·3	88·0	97·0	88·4	96·5	100·0	88·0	94·1	
28·0	129·9	126·1	134·2	137·0	124·5	132·0	143·8	140·2	130·0	136·4	130·5	140·3	141·5	132·2	136·2	1
91·0	103·5	99·0	101·0	97·0	89·0	96·0	103·6	102·8	97·8	107·2	101·3	99·8	99·0	94·0	99·6	1
94·0	111·0	105·2	105·5	113·8	105·8	109·2	115·6	115·0	111·2	115·6	106·0	120·0	113·6	111·6	111·0	1
47·0	142·5	132·0	140·5	133·4	130·5	132·9	134·8	142·5	123·8	141·7	143·8	140·5	137·5	141·1	142·0	1
19·0	122·5	112·5	119·0	120·8	113·0	115·5	123·7	121·5	108·5	125·5	117·0	114·5	120·5	117·0	122·5	1
72·0	65·4	62·0	63·0	65·8	61·5	69·0	66·9	66·0	71·7	60·8	68·8	56·0	68·6	60·6	65·1	
66·2	71·6	69·2	73·0	74·9	75·1	67·4	69·8	72·1	66·0	73·8	71·9	74·5	67·0	72·0	69·7	
41·8	43·0	48·8	44·0	39·3	43·4	43·6	43·3	41·9	42·3	45·4	39·3	49·5	44·4	47·4	45·2	
29·0	87·5	82·9	86·3	88·5	86·2	84·0	87·6	86·5	84·3	94·2	81·0	91·8	81·8	86·0	86·1	
12·8	27·1	35·1	30·7	25·7	32·3	27·0	25·5	27·5	24·0	25·0	30·2	32·2	29·6	23·4	28·8	
5·5	15·9	13·7	13·3	13·6	11·1	16·6	17·8	14·4	18·3	20·4	9·1	17·3	14·8	14·0	16·4	
	4·2	6·2	2·9	3·9	5·5	11·0	8·0	1·0	7·0	6·5	11·5	4·0	2·0	5·0	2·8	
71	378	357	361	349	347	355	368	367	343	375	383	351	361	365	369	
27	125	124	127	126	122	120	131	132	129	129	137	132	124	127	130	
27	139	128	119·5	114	116	122	120	128	100·5	138	131·5	114	120	129	132	
17	114	105	114·5	109	109	113	107	107	113·5	108	114·5	105	117	109	107	
32	331	322	325	344	326	320	348	343	320	346	320	342	340	323	338	
12·5	109·8	107·9	111·2	111·0	107·8	108·0	115·3	114·0	113·5	114·5	119·6	117·3	111·7	110·0	114·0	11
98·6	101·2	92·6	96·2	94·6	94·3	99·0	96·0	94·8	97·5	95·4	99·4	94·5	102·4	99·0	96·5	9
98·5	506·5	490·0	490·0	510·0	492·0	488·0	527·0	518·0	507·5	514·0	501·5	515·0	506·0	492·5	498·5	50
96·6	102·4	100·0	104·4	110·0	104·5	108·2	108·0	112·0	111·0	105·8	99·0	106·2	112·0	100·5	109·5	10
51·0	49·2	52·0	53·3	50·5	51·0	50·9	55·6	48·8	53·0	50·9	49·3	57·0	51·1	55·9	53·0	5
25·2	24·3	23·0	27·8	25·3	23·3	28·0	28·4	26·0	25·5	28·2	29·0	26·0	25·5	23·8	23·0	2
33·0	29·5	36·5	34·0	31·4	34·2	31·5	36·4	35·1	32·9	32·2	33·3	36·0	32·8	32·5	34·8	3
33·0	29·9	36·5	33·5	33·5	34·2	32·1	36·4	35·3	33·4	32·2	32·4	37·0	31·8	32·5	36·6	3
38·8	37·9	37·0	37·0	39·3	34·4	39·1	40·6	38·4	38·8	38·3	39·0	40·5	39·2	36·0	38·0	4
38·0	37·2	36·0	37·0	38·5	34·7	38·7	40·8	39·5	38·4	38·3	39·0	39·2	39·2	35·9	37·2	4
55·0	48·5	45·5	46·0	49·0	44·5	49·5	51·0	50·0	52·5	47·0	50·5	43·5	55·5	50·0	44·5	5
36·0	44·0	35·5	38·5	35·5	33·5	40·5	38·5	37·0	36·0	38·5	39·0	38·5	39·0	33·5	38·0	3
34·9	37·0	36·5	37·5	35·2	37·6	36·6	38·0	37·0	35·6	40·0	32·1	34·8	34·0	35·0	36·5	3
28·4	29·9	29·8	29·2	33·0	28·7	29·5	34·0	29·0	30·0	29·5	30·0	34·8	31·7	30·9	33·6	2
0·57	81·19	85·67	84·99	94·87	92·98	83·33	89·39	89·08	88·91	85·68	80·06	95·29	91·94	84·03	88·55	9
78·29	80·74	78·80	84·99	80·60	79·72	79·11	77·25	81·89	71·85	81·81	81·94	84·13	82·09	83·49	85·54	8
92·99	100·56	108·71	100·00	117·69	116·63	105·34	115·73	108·77	123·75	104·73	97·71	113·17	112·00	100·64	103·52	11
71·09	69·76	70·70	69·80	65·47	77·09	73·96	73·16	68·38	73·21	68·28	66·63	79·76	73·23	78·93	71·89	7
94·39	96·62	94·71	93·79	94·69	91·66	101·66	99·51	95·84	103·37	91·41	98·81	86·40	101·57	91·66	96·40	9
88·18	66·71	65·13	66·11	67·18	67·84	71·74	67·02	63·99	67·02	68·53	65·68	68·89	72·21	64·36	66·40	8
71·05	68·71	67·34	60·79	64·74	64·23	65·82	70·87	68·18	63·30	67·67	64·87	71·74	65·96	74·20	72·21	6
59·41	49·39	44·23	52·16	50·09	45·69	55·01	51·08	53·29	48·11	55·40	58·83	45·61	49·90	42·58	43·39	4
85·01	77·84	98·65	91·89	79·89	99·42	85·56	89·65	91·41	84·79	84·07	85·38	88·89	83·67	90·28	91·58	9
85·01	80·29	101·39	90·54	87·01	98·56	82·95	89·22	89·37	86·98	84·07	81·79	94·38	81·12	90·53	98·39	9
85·45	90·72	78·02	83·69	72·45	75·28	81·81	75·49	74·00	68·57	81·92	77·23	88·51	70·27	67·00	85·84	6
81·38	80·81	81·65	77·87	93·75	76·33	80·60	89·47	78·38	84·27	73·75	93·46	100·00	93·24	88·28	92·06	8

21	124	125	126	127	129	130	132	133	135	136	137	138	139
4	25	29	29	38	25	20	22	40	25	60	25	27	17
00	1560	1435	1315	1560	1420	1435	1455	1380	1440	1325	1315	1170	1460
83	586	725	452	700	602	480	615	657	550	592	600	542	402
·0	166·0	165·5	168·0	171·0	165·5	169·0	174·0	173·0	172·0	159·0	168·5	155·0	171·0
·1	128·4	130·7	128·0	131·0	129·1	127·5	134·3	131·5	130·2	130·7	122·0	115·5	121·2
·0	94·6	98·0	96·0	94·9	95·5	94·5	99·3	97·0	98·9	98·9	93·6	85·4	91·1
·0	91·2	92·4	95·1	96·2	95·3	96·2	97·0	98·0	91·3	84·5	90·0	88·3	79·0
·2	71·6	77·0	75·0	80·0	69·1	69·6	67·5	66·5	66·5	63·0	69·5	64·0	60·5
·0	147·0	155·5	144·0	157·5	150·5	146·5	150·0	141·5	158·5	150·0	138·0	141·5	138·5
·0	94·1	98·2	87·3	91·0	93·6	96·0	95·0	95·3	96·2	88·0	91·1	87·1	94·0
·2	136·2	141·4	134·0	141·5	135·3	130·2	136·0	133·0	135·5	133·5	131·5	132·0	121·5
·0	99·6	104·8	97·0	100·0	100·0	98·0	102·1	97·0	100·6	95·0	103·4	91·5	88·7
·6	111·0	116·2	108·4	119·8	110·0	110·6	107·2	106·6	117·6	103·0	104·4	104·4	102·0
·1	142·0	140·3	129·8	140·9	136·5	131·6	131·0	131·0	135·0	143·7	136·0	123·0	137·8
·0	122·5	120·7	109·8	121·5	118·0	120·3	113·0	117·0	117·0	120·0	114·0	111·0	119·5
·6	65·1	62·3	66·3	65·9	68·5	69·7	66·4	71·0	63·4	57·8	65·0	70·8	58·5
·0	69·7	70·0	67·8	64·8	69·4	68·0	73·4	69·0	76·0	83·2	70·6	66·2	80·6
·4	45·2	47·7	45·9	49·3	42·1	42·3	40·2	40·0	40·6	39·0	44·4	43·0	40·9
·0	86·1	86·3	83·2	83·7	82·5	84·0	89·4	83·7	92·0	90·0	86·1	84·6	93·0
·4	28·8	31·4	30·5	30·4	29·0	26·3	24·2	25·3	24·6	32·2	28·9	24·6	28·5
·0	16·4	16·3	15·4	18·9	13·1	16·0	16·0	14·7	16·0	6·8	15·5	18·4	12·4
·0	2·8	2·6	14·2	12·0	−1·0	13·0	1·0	14·2	0·0	5·7	8·0	4·0	6·5
35	369	348	351	372	350	361	354	368	350	351	377	335	379
27	130	120	127	130	124	120	137	121	123	128·5	126·5	124	125
29	132	117	102	120	120	128	112	141	119	115	131·5	114	129
09	107	111	122	122	106	113	105	106	108	107·5	119	97	125
23	338	335	308	341	332	334	320	318	337	340	306	312	319
·0	114·0	111·2	113·8	115·2	112·3	108·0	117·3	105·5	109·5	114·0	109·5	105·5	107·4
·0	96·5	98·0	100·8	99·8	95·0	99·0	93·0	90·0	99·0	94·0	92·4	81·0	107·2
·5	498·5	501·0	489·0	515·0	492·0	493·5	510·5	504·0	508·0	486·5	490·0	475·0	493·5
·5	109·5	103·5	105·0	109·0	107·8	110·0	111·2	102·2	111·5	101·4	102·4	98·6	101·2
·9	53·0	52·0	54·0	58·2	54·2	48·0	50·3	48·0	51·0	52·0	51·5	49·0	45·0
·8	23·0	23·0	27·5	26·1	25·2	21·1	25·5	25·0	25·6	24·3	26·2	24·2	24·0
·5	34·8	36·4	34·6	35·0	33·0	33·5	30·3	30·0	31·5	38·3	31·5	30·3	30·4
·5	36·6	37·0	34·6	35·0	33·0	35·0	30·3	31·1	32·1	36·5	31·5	30·8	32·2
·0	38·0	40·0	39·7	39·3	41·0	38·5	37·0	37·1	38·3	39·4	38·2	35·5	36·0
·9	37·2	40·0	37·8	39·5	40·0	39·0	37·0	36·9	39·0	40·0	37·5	35·5	33·0
·0	44·5	55·0	51·0	52·0	52·0	50·0	45·0	52·0	46·0	42·0	43·0	47·0	39·0
·5	38·0	37·0	38·5	44·0	39·0	39·5	37·5	37·5	38·0	37·5	42·0	38·5	37·0
·0	36·5	36·0	33·0	37·0	36·5	33·5	36·8	36·0	32·8	34·5	29·5	32·0	32·4
·9	33·6	29·5	29·0	33·0	31·1	28·5	29·9	29·0	29·2	31·5	29·9	28·0	29·5
4·03	88·55	93·96	85·71	92·11	90·94	86·68	86·21	81·79	92·15	94·34	81·89	91·29	80·99
3·49	85·54	84·77	77·22	82·39	82·47	77·87	75·29	75·72	78·49	90·38	80·71	79·35	80·58
0·64	103·52	110·83	110·94	111·78	110·25	111·32	114·50	108·02	117·41	104·39	101·47	115·04	100·50
8·93	71·89	73·47	77·32	80·00	69·10	71·02	66·11	68·55	66·00	66·32	67·21	69·94	68·21
1·66	96·40	94·29	99·06	101·37	99·79	101·79	97·68	101·03	92·32	85·44	96·15	103·39	86·72
4·36	66·40	81·40	70·66	68·35	73·42	71·74	62·86	65·40	69·26	68·53	64·36	62·15	63·30
4·20	72·21	67·50	59·29	58·52	70·66	66·25	68·18	61·86	77·11	65·82	55·60	60·15	63·08
2·58	43·39	44·23	50·93	44·85	46·49	43·96	50·69	52·08	50·19	46·73	50·87	49·39	53·33
0·28	91·58	91·00	87·15	89·06	80·49	87·01	81·89	80·86	82·24	97·21	82·46	85·35	84·44
0·53	98·39	92·50	91·54	88·61	82·50	89·74	81·89	84·28	82·30	97·07	84·00	86·76	97·58
7·00	85·84	67·27	75·49	84·61	75·00	79·00	83·33	72·11	82·61	89·29	97·61	81·91	94·87
8·28	92·06	81·94	87·87	89·18	85·21	85·07	81·25	80·56	89·02	91·30	101·36	87·50	91·05

To face p. 278

A BIOMETRIC STUDY OF ONE HUNDRED AND TEN ASIATIC MANDIBLES.

By GORDON HARROWER, M.B., Ch.B., D.Sc., F.R.S.E., Professor of Anatomy, King Edward VII College of Medicine, Singapore.

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1. *Introductory.* The publication of this paper marks the completion of a study of certain Asiatic crania which I commenced in 1922. The material was personally collected and prepared by me, and the question of age, sex and nationality is beyond doubt. The distinguishing numbers of the mandibles correspond to the numbers used for the crania in my publications. The material is representative of three Asiatic peoples, namely, Tamils, a Dravidian people from Southern India and Ceylon, Hokiens (or Fo-kiens), hailing from the district of Fo-chow in China, and Hylams, a branch of the Chinese from the island of Hainan in the China Sea, off the coast of Annam. Owing to defects due to loss of teeth in a few mandibles which prevented essential measurements being taken, I have had to omit certain mandibles belonging to crania for which I have published the cranial measurements. I have also added three mandibles to the Hokien series to keep the numbers as large as possible. As the skulls to which they belong were collected after the publication of my paper on the Hokien skulls, no measurements for these crania have been given.

To the best of my knowledge there is no comparative material available except that of Dr Morant published as an appendix to his paper on the Tibetan skull in *Biometrika*, Vol. XIV. pp. 253—260*. His Tibetan A series includes only 16

* [Mandible measurements have been published in *Biometrika* for: Nepalese and the revised series of Tibetan A in Vol. XVI. 1924, pp. 103—4; Anglo-Saxons, Vol. XVIII. 1926, p. 96; and Badari Egyptians, Vol. XIX. 1927, p. 149.—Ed.]

specimens and the Tibetan B series 12 only, and of these latter, the average values for certain measurements are based on seven mandibles only. We are indebted, however, to the Biometric Laboratory for having formulated a scheme of measurements which I have followed closely. In one or two particulars I have deviated from the methods described when I considered I could obtain more accurate values, especially with reference to angular measurements. These differences in technique will be discussed later.

A general survey of the mandibles of three series gives the impression that the Hokiens possess a heavier and more solid type of mandible than the other two racial series. The teeth of the Tamil series are best preserved. The Hylam teeth show the greatest incidence of dental disease. From personal observation, I consider that Asiatics take better care of their teeth than Europeans. With most Tamils even of the lowest class the hygiene of the mouth becomes almost a ritual, although the methods employed do not conform to the accepted European standards. The habit of betel chewing which is universal among the Tamils tends to preserve the teeth on account of the astringent effect. Further, the ground betel nut is mixed with lime which assists in neutralising the acidity of the mouth and thereby checking the deposit of tartar. Yet, in spite of these favourable conditions, pyorrhœa alveolaris is comparatively frequent and root abscess with absorption of bone not uncommon.

TABLE I.

The Presence of the 3rd Molar Tooth according to Age Groups.

Race	Age	Erupted	Present but not Erupted	No Evidence
Hylam ...	*20* or under	1	2	—
	21—24	—	1	2
	25—29	14	—	—
	30—34	1	—	2
	35 or over	11	—	5
Tamil ...	*20* or under	1	1	—
	21—24	3	—	—
	25—29	6	—	—
	30—34	4	—	—
	35 or over	14	—	2
Hokien ...	*20* or under	1	—	1
	21—24	—	—	2
	25—29	6	—	3
	30—34	5	—	2
	35 or over	12	—	6

While applying the mandibles to the skulls for the purpose of measuring the angles made with the Frankfurt plane, I was interested to find that 5 Tamil crania out of a total of 33, and 6 Hylam out of 39, had an exact approximation bite instead of the more common "scissors" bite. The question of the dental arrangement is interesting since prophylactic dentistry among children is not practised. Without exception the molar teeth are well spaced; in one mandible of the Hokien series the left second bicuspid is crowded onto the medial aspect of the alveolus and the posterior margin of the first bicuspid is in contact with the anterior margin of the first molar. In 12 Hylam, 14 Hokien and 17 Tamil the spacing of the teeth is perfect, that is 43 out of 110 mandibles, or 39·1 °/₀ with perfect spacing. In all of the others there is a distinct tendency to crowding of the incisor and canine teeth apparently due to the narrowing of the arch into a parabolic form. In view of the tendency to degeneration of the third molar tooth it is interesting to note that out of a total of 101 adult Asiatic mandibles, 76 have the wisdom teeth erupted on one or both sides, a percentage of 75·2. For the benefit of those interested in this side of the question I have tabulated the results in age groups (Table I).

2. *Measurements and Methods of Measurement.* I have followed the plan of the Biometric Laboratory closely and the definition of points are here only briefly stated. A more detailed account will be found in Dr Morant's paper on the Tibetan skull. It is advisable to mark all points as far as possible on the mandibles before taking the measurements. Some of the points are obtainable only on the apparatus used for measuring the bones. In order to simplify the technique of measurement, and at the same time give a reasonable amount of exactitude, measurements are referred to a conventional plane called by Morant the "standard basal plane" and defined as the horizontal plane with which contact is made at three or more points when a vertical pressure is applied to the second molar tooth or its cavity. The mandible is then said to be in the "standard basal position." The inclination of the standard basal plane to the Frankfurt horizontal is also measured with the mandible in position on the skull. A second plane, the "standard rameal plane," is also used, and is defined as the plane which makes contact with two points on the posterior border of the left ramus (usually one at the condyle and a second point near the angle) and one or more points on the posterior border of the right ramus, when the mandible is in the standard basal position. The intersection of the standard basal and rameal planes is the gonial axis.

For several of the measurements a mandible board is necessary. I had not previously seen a mandible board, but from the description given by Dr Morant I was able to construct one. The instrument consists of a fixed horizontal board having hinged to it a vertical board called the rameal wing which can be inclined at any angle from 0° to 180° with the horizontal wing. A protractor with a movable arm is fixed to the edges of the board so that angles can be read off directly, and millimetre scales let into the surfaces of each wing in positions which permit of direct measurements with the aid of a square of the projections of certain points.

The diagram shown in Fig. 1 (p. 285) serves to explain the apparatus*. Where measurements are taken on one side only the left is used.

Coronion (c_r) = point of contact on coronoid process of a plane which also makes contact with the condyle of the same side and the coronoid or condyloid process of the opposite side. Obtained by inverting the mandible on a flat surface.

condylion (c_y) = point on condyle obtained in same way as coronion.

gnathion (g_n) = lowest point on symphyseal plane when mandible is in standard basal position.

pogonion A (p_a) = most projecting point of mental protuberance when mandible is in the standard basal position.

pogonion B (p_b) = most projecting point of mental protuberance when mandible is *in situ* on skull in Frankfurt horizontal.

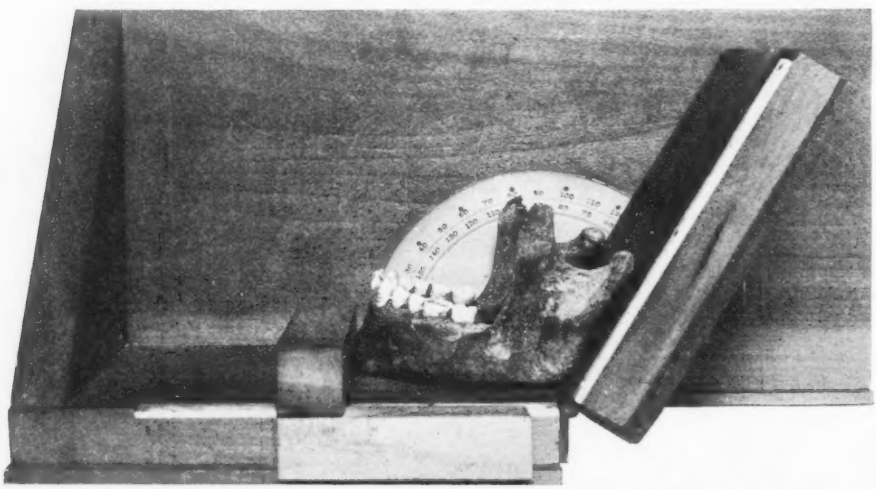
infradental (d_f) = point where sagittal plane of mandible meets the horizontal tangent to the alveolar rims of the middle incisors.

intradental (d_t) = tip of process between middle incisors.

gonion (g_o) = point on angle nearest to gonial axis.

w_1 = condylar width, the greatest width of mandible at condyles from outside of one condyle to outside of the other.

* [A photograph of the mandible board in use in the Biometric Laboratory is here provided. The white strips are ivory scales with zero in the axis of the hinge of the movable flap; a mandible is in position for reading the $\angle M$; the solid set square is adjusted to read on the horizontal scale the distance from "gonial axis" to pogonion A.



This particular mandible board was designed by Professor Sir George Thane, Dr Derry and the present editor in consultation.—Ed.]

w_2 = greatest width of mandible from outside of one angle to the outside of the other.

h_1 = sagittal height of mandible measured from gnathion to intradental.

zz = least distance between the inner rims of the mental foramina.

$c_r c_r$ = coronial breadth between coronia.

rb = least breadth of ramus parallel to standard basal plane. A line is drawn across the ramus when the mandible is in the standard basal position.

rb' = least breadth of ramus in any direction.

G_2' = breadth of mandible between inner alveolar walls at middle of second molars.

$c_y c_r$ = left condylion to left coronion.

$g_o g_o$ = gonion to gonion.

$g_n g_o L$ = gnathion to left gonion.

$g_n g_o R$ = gnathion to right gonion.

$c_y l$ = greatest length of condyle.

$c_y b$ = greatest breadth of condyle at right angles to $c_y l$.

$m_2 p_1$ = distance on external surface of mandible between middle of second molar and middle of first premolar.

$p_a d_t$ = pogonion *A* to intradental.

$p_a g_n$ = pogonion *A* to gnathion.

$p_a d_f$ = pogonion *A* to infradental.

$g_n d_f$ = gnathion to infradental.

$p_a p_b$ = pogonion *A* to pogonion *B*.

$g_o p_a g_o$ = bigonial arc from one gonion round pogonion to the other gonion.

Measurements made on the Mandible Board.

ih = least height of incisura taken with scrib awl.

ih' = greatest depth of incisura from coronion condylion plane when mandible is inverted on mandible board.

$c_r h$ = height of coronion
$c_y h$ = height of condylion
$d_t h$ = height of intradental
$m_2 h$ = height of outer alveolar margin at middle of second molar
$p_1 h$ = height of outer alveolar margin at middle of first premolar

} at right angles to the standard basal plane.

$c_p l$ = length of corpus from gonial axis to pogonion *A*.

rl* = length of ramus projected on to rameal wing of mandible board when mandible is in the standard basal position and the rameal wing of board is in the standard rameal plane.

ml = maximum length of mandible from the posterior borders of condyles to pogonion A taken on mandible board with mandible in standard basal position and rameal wing of board vertical.

Indices.

$100c_rh/ml$ = height-length index.
$100c_rc_r/ml$ = breadth-length index.
$100g_og_o/c_pl$ = corpus breadth-length index.
$100rb'/rl$ = rameal breadth-length index.
$100c_yb/c_yl$ = condylar breadth-length index.
$100g_og_o/c_rc_r$ = gonial-coronoidal breadth index.
$100c_yh/c_rh$ = condylar-coronoidal height index.
$100ih'/c_rc_y$ = incisural depth-length index.
$100d_th/c_rh$ = intradental-coronoidal height index.

Angular measurements.

$\angle M$ = angle between the standard basal plane and standard rameal plane.

$\angle R$ = angle between the posterior border of the left ramus and the plane which makes contact with left condylion and coronion and either the right condylion or coronion whichever is the more projecting. Taken with mandible inverted on mandible board.

$\angle G$ = gnathio-gonial angle or angle subtended at the gnathion by the lines joining the gnathion to the two gonia. The angle is calculated from the lengths of the sides of the triangle, namely, g_ng_oL, g_ng_oR, and g_og_o.

$\angle C'$ = angle between the standard basal plane and a line joining pogonion A to infradental.

$\angle L$ = angle between the Frankfurt horizontal plane and a line joining pogonion A with infradental.

$\angle L'$ = angle between the Frankfurt horizontal plane and a line joining pogonion B with infradental.

$\angle F$ = total profile angle or angle between the Frankfurt horizontal plane and a line joining pogonion B with nasion.

$\angle S$ = angle between the standard basal and Frankfurt horizontal planes.

* [The length of ramus is, perhaps, hardly sufficiently defined in *Biometrika*, Vol. xiv. p. 258. The description should run: Length of ramus, Projection of left condyle on to the rameal wing of mandible board, with the mandible in the same position as for finding c_pl. The coronoid process may occasionally give a greater projection than the condyle, but it is probable that Professor Harrower has always used the condyle as we have invariably done.—Ed.]

With regard to the angles L, L', and F, Dr Morant made the measurements with the skull resting on the calvarium and the base uppermost*. I consider that it is simpler to make these measurements with the base downwards and the skull adjusted to the Frankfurt horizontal plane on the craniophor. By placing a small piece of plasticene in each glenoid cavity and pressing the mandible on to the skull until the teeth are in exact apposition, a very accurate approximation to the conditions during life can be obtained. A small rubber band with a hook at each end is sufficient to support the front of the mandible. Fig. 1 explains the arrangement of the apparatus. Dr Morant obtained the angle S by subtracting the angle C' from the angle L, but he states "no great reliance can be placed on its accuracy

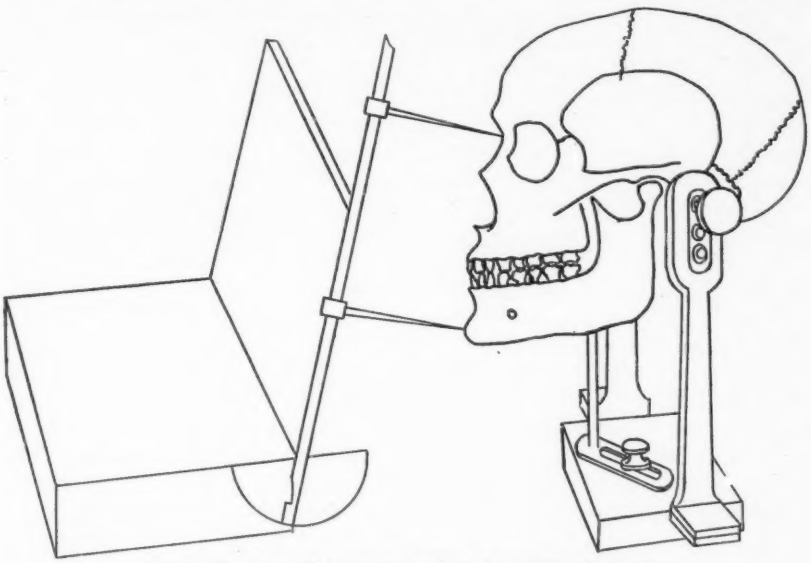


Fig. 1. Diagram to illustrate the method of measuring the angle F.

since the angle L is rather an uncertain measurement†." The angle S I have taken by direct measurement. When the mandible was in the standard basal

* [Of course, adjusted to the Frankfurt plane; it is customary in the Biometric Laboratory to do a good deal of work on the skull with its calvarium based on a plasticene bed on a Klaatsch craniophor and adjusted to the Frankfurt plane by aid of the scrib awl and the marked points on the skull which determine that plane. It is of course a mere matter of convenience which position is adopted for adjusting the mandible, but our personal experience is that for skulls with relatively few teeth preserved the adjustment in this way is less precarious. Prof. Harrower, using macerated specimens, probably had as a rule more teeth in position than is the case with excavated crania.—ED.]

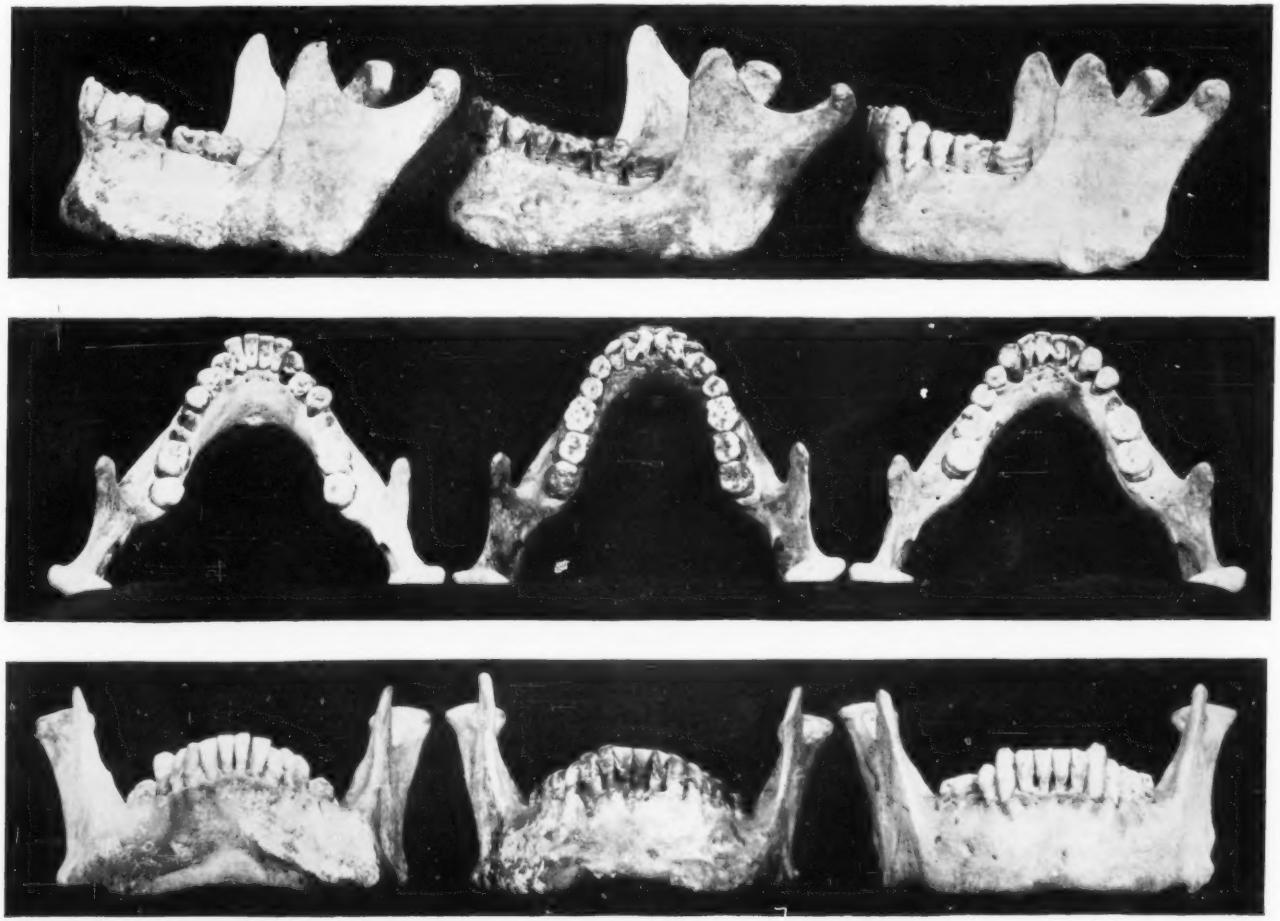
† [It is not only the uncertainty of the adjustment of the bite, especially when the teeth are worn or partly missing, but the fact that the probable error in measuring an angle increases rapidly as the distance between the two points which determine the position of one of its legs diminishes. In this case the pogonion and infradental are again by no means definite points in the mathematical sense, and the determination of the angle L is subject to much personal equation.—ED.]

position I drew a line parallel to the standard basal plane across the ramus. By the use of a set square and the rameal wing of the mandible board I was able to measure the angle between the line parallel to the standard basal plane and the back of the rameal wing. By deducting 90° from this reading the angle S is obtained*. In my measurements the angles L, C', and S are taken independently of one another. If the angles C' and S be added together the result should be L. That my values are correct may be confirmed by the addition of these separate quantities†. This confirmatory test cannot be applied to Dr Morant's values as the angle S depends on the angles L and C', being calculated from them.

3. *Comparison of Average Values.* Table II gives the average values of the various measurements taken, and indices calculated. A general survey shows that the various means are remarkably similar in value. As these crania are entirely Asiatic it would be interesting to have a series of European mandibles for comparison. Having regard to the considerable differences in the breadths of the corresponding skulls it is somewhat remarkable that the maximum widths between the condyles should show such a small range of difference, in the four series compared. Tamils are dolichocephalic and Tibetans A are mesaticephalic. The mean maximum breadth of the Tibetan A skull is 139·4 mm. and of the Tamil 131·5 mm., a difference of 7·9 mm., and yet the mean maximum intercondylar width differs by only 0·1 mm. The Hokiens belong to the mesaticephalic group while the Hylam are distinctly brachycephalic. The mean maximum breadth of the Hokien skull exceeds the Tibetan A by only 1·5 mm. but the mean maximum intercondylar width exceeds the Tibetan A by 4·1 mm. The Hylam mean maximum breadth is 6·9 mm. greater than the Hokien, yet the intercondylar widths vary only by 0·6 mm. It would thus appear that the width of the base of the skull which is laid down in cartilage is a fairly constant value in man, as far as one can judge from the values at our disposal, the width of the skull in its membranous part being liable to extreme variation. The inter-angular widths reflect the same condition of constancy, the two Chinese means differing by only 1·3 mm., and the Tamil and Tibetan means being equal. It was

* [I venture to think that Prof. Harrower's construction for the angle S can be shown mathematically to be incorrect. What he draws on the ramus is a line in a plane parallel to the standard mandible plane; this line will not meet the trace of the standard plane on the Frankfurt plane at right-angles, unless the wall of the ramus is parallel to the median sagittal plane of the mandible. If he puts the edge of his set-square against this line, he will with the usual slope of the ramus plane get *too small* a value of the angle S.—Ed.]

† [This confirmatory test would be valuable, if a satisfactory method of determining S which is really independent of C' and L could be used. Prof. Harrower's method must I think give S too small. In his measurements on individual mandibles he reads on a protractor to 0°·1. He has measured 330 angles and for every triplet except six, i.e. in 104 triplets, the relation $S+C'=L$ is *absolutely* satisfied. In two of these six triplets $S+C'=L'$ instead of L (skulls 100 and 142); in a third there is an error of an entire degree in the relation $S+C'=L$ (skull 105); in a fourth there is an error of a complete nine degrees (skull 18); only in two (skulls 8 and 96) are there errors of exactly 0°·5. Thus probably four out of the six cases are errors of copying. I venture to suggest, however, seeing that S ought not to be the correct value, that the relation $S+C'=L$ has been used either to obtain one of the three angles or to adjust their values after obtaining them. It seems impossible that 330 angles should be read off on ordinary craniometric goniometers to tenths of a degree with sufficient accuracy to satisfy for 312 angles the inter-angular relation.—Ed.]



Hylam Tamil Hokien

TABLE II.

Comparative Table of Mean Values of Asiatic Mandibles.

Character	Tibetan A		Hokien		Hylam		Tamil	
	Mean	No.	Mean	No.	Mean	No.	Mean	No.
w_1 ...	117·8	16	121·94	38	122·50	39	117·70	33
w_2 ...	95·3	16	100·95	38	99·60	39	95·37	33
h_1 ...	30·7	15	35·19	38	32·71	38	30·15	33
zz ...	45·1	16	46·83	38	46·74	39	45·09	33
$c_r c_r$ ...	94·6	16	97·17	38	98·21	39	94·52	33
rb ...	36·8	16	39·36	38	38·59	39	35·98	33
rb' ...	31·4	16	34·42	38	33·22	39	31·65	33
G_2' ...	47·6	16	43·85	38	46·82	35	42·66	33
$c_y c_r$ ...	34·8	16	35·43	38	34·93	39	34·29	33
$g_o g_o$ ...	92·9	16	95·44	38	94·56	39	91·85	33
$g_a g_o L$ ...	83·4	16	83·08	38	82·64	39	81·86	33
$g_a g_o R$ ...	83·7	16	82·33	38	83·19	39	81·62	33
$c_y l$ ...	18·6	16	20·05	38	19·41	39	19·49	33
$c_y b$ ...	7·9	16	8·85	38	8·62	39	8·60	33
$m_2 p_1$ ...	29·3	15	30·19	33	28·51	38	29·04	33
$p_a d_t$ ...	25·9	15	29·95	38	27·18	38	24·83	33
$p_a g_a$ ...	7·7	16	7·50	38	7·77	39	8·09	33
$p_a d_f$ ...	23·0	15	27·53	38	25·32	38	21·35	33
$g_a d_f$ ...	28·2	15	32·91	38	30·74	38	27·16	33
$p_a p_b$ ...	3·6	16	5·26	38	5·01	39	3·61	33
$g_o p_a g_o$ ...	187·4	16	189·79	38	190·27	39	186·74	33
ih ...	40·4	16	47·15	38	45·44	39	44·80	33
ih' ...	16·3	16	13·63	38	14·86	39	13·53	33
$c_r h$ ...	60·7	16	65·88	38	63·75	39	61·15	33
$c_y h$ ...	49·6	16	56·81	38	55·09	39	55·17	33
$d_t h$ ...	34·8	15	39·69	38	36·88	38	34·39	33
$m_2 h$ ...	23·3	16	28·64	34	26·28	39	24·62	33
$p_1 h$ ...	28·4	16	32·84	38	31·30	39	28·50	33
$c_y l$ ...	74·0	16	73·78	38	74·71	39	74·42	33
rl ...	57·8	16	61·47	38	60·41	39	59·36	33
ml ...	105·1	16	102·83	38	103·68	39	102·78	33
$100\, c_r h/ml$	57·8	16	64·02	38	61·68	39	59·42	33
$100\, c_r c_r/ml$	89·8	16	94·70	38	95·11	39	92·26	33
$100\, g_o g_o/c_y l$	125·8	16	129·94	38	127·18	39	123·84	33
$100\, rb'/rl$	54·5	16	55·97	38	55·28	39	53·36	33
$100\, c_y b/c_y l$	42·7	16	44·49	38	44·74	39	44·29	33
$100\, g_o g_o/c_r c_r$	98·4	16	98·07	38	96·37	39	97·28	33
$100\, c_y h/c_r h$	81·7	16	85·99	38	86·30	39	90·32	33
$100\, ih'/c_r c_r$	46·9	16	41·30	38	42·94	39	39·64	33
$100\, d_t h/c_r h$	57·6	15	60·43	38	58·15	39	56·51	33
Angles M ...	126°·1	16	121°·03	38	122°·12	39	122°·37	33
Angles R ...	71°·4	16	74°·71	38	73°·09	39	69°·91	33
Angles G ...	67°·7	16	70°·46	38	69°·60	39	68°·25	33
Angles C' ...	61°·4*	15	77°·10	38	72°·36	39	71°·03	33
Angles L ...	96°·8	15	104°·84	38	98°·73	39	90°·89	33
Angles L' ...	95°·1	15	104°·49	38	98°·65	39	90°·03	33
Angles F ...	91°·7	16	92°·98	38	90°·79	39	89°·59	33
Angles S ...	35°·4*	15	27°·52	38	26°·09	39	19°·86	33

* Error suspected, vide p. 291 [and footnote.—ED.]

rather surprising to me to find the distances between the mental foramina in such close harmony, the maximum difference in the means of the four series being only 1·7 mm., the Tamil and Tibetan values being equal, while the two Chinese means show only a fractional difference. The explanation of this constancy is probably to be found in the fact that the portion of the mandible between the mental foramina has incorporated Meckel's cartilage in itself during development.

The minimum breadth of the ramus in any direction is, I believe, a more useful measurement than the width taken parallel with the standard basal plane. Here again, the remarkable similarity in values between the Tibetan and the Tamil series is surprising, the difference being only 0·25 mm. The Chinese values are slightly larger, but the difference between Hylam and Hokien is only 1·2 mm. Still more surprising is the close approximation of the values for the distance between condylion and coronion. I frankly admit that had I been asked concerning this measurement I would have said that this value would vary widely, yet the difference between the smallest value (the Tamil) and the highest (the Hokien) is only 1·1 mm. or 3·1 % of the mean Hokien value. Another interesting feature is the measurement round the mandible from one gonion to the other through the pogonion. In spite of the fact that the personal element can operate in fixing the gonion, the maximum difference in the highest and lowest mean values, that is between the Hylam and Tamil, is only 3·6 mm. or approximately 2 % of the highest mean value.

The sagittal height of the mandible between the gnathion and the infradental is not such a constant value. The same variation is recorded approximately in the measurement taken from the standard basal plane to the intradental. The difference between the extremes of the mean values in both cases is approximately 5 mm., quite a considerable amount, equal to approximately 14 % of the Hokien mean value. The mean length of the body of the mandible in the four series is very close. One might infer that such would be the case from the closeness of the values for $g_o p_o g_o$. Curiously enough the Hokien body is shortest at 73·78 mm., the Hylam longest at 74·71 mm., yet the maximum difference is only 1·2 %. Considering next the length of the ramus we find that the values are rather wider, the Hokien having the largest value and the Tibetan the least, the difference between them being 3·7 mm. Comparing these values with the other ramus length value, namely, the height of the condyle from the standard basal plane, we find that the Tibetan has the very low value of 49·6 mm., while the Hokien, Hylam and Tamil are approximately equal round 56 mm. In view of the similarity of the other values I am inclined to question Dr Morant's value which may be due to a printer's error*. The probability of this being an error is enhanced by the fact that Dr Morant quotes a value of 54·9 mm. for the mean of 12 of his Tibetan B mandibles. As regards the total length of the mandible (*ml*) one would hardly expect such a close series of values as we find for the four races compared. This

* [This is not an error. Nine further Tibetan A crania in the British Museum (Natural History) gave a mean of 52·9, and the whole series of 25 a mean of 50·8.—Ed.]

measurement depends to some extent on the angle the ramus makes with the body and also on the degree of prognathism or its absence. The Tamils are the least prognathous of the four and their total mandibular length is the shortest. The Tibetans are less prognathous than either the Hylam or the Hokiens, yet their total mandi-

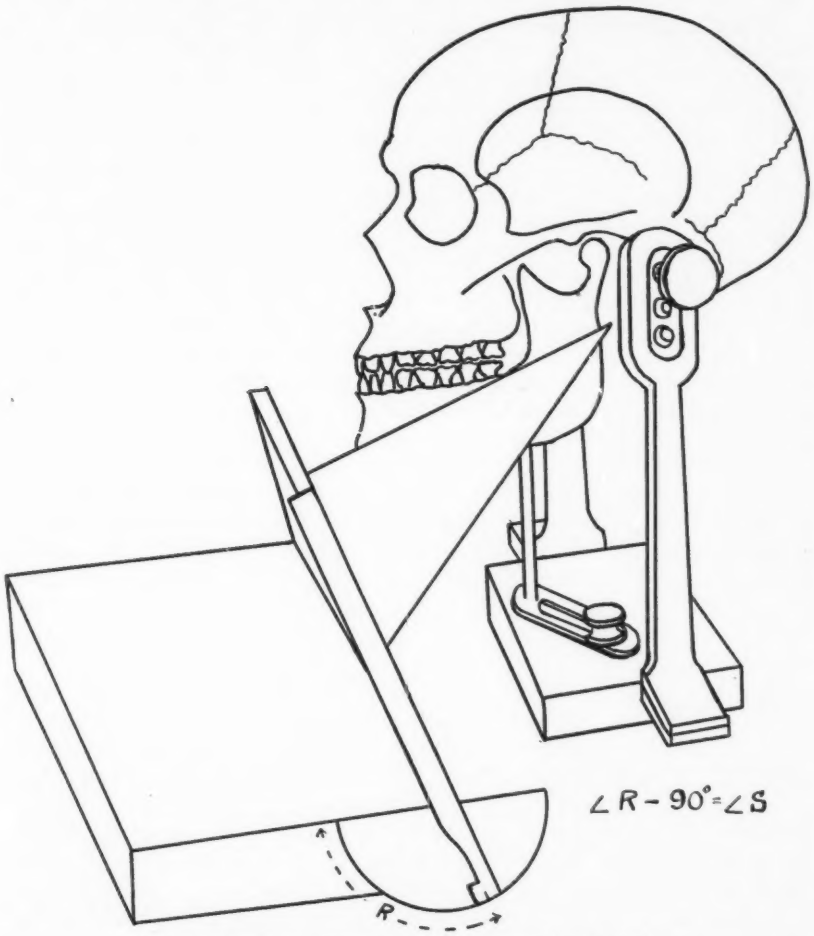


Fig. 2. Diagram to illustrate the method of measuring the angle *S*.

bular length is greatest, the Hokiens having the highest gnathic index. Obviously prognathism is not the main factor in determining the length of the mandible. Further, the Tibetans have the shortest basi-alveolar length, the Hylam the second, and the Tamils and the Hokiens have practically equal values. This corresponds to

the arrangement of the mandibular lengths but in reverse order, the shortest basi-alveolar length having the longest mandibular length and vice versa. Examination of the mandibular angle helps to explain the values. The Tibetans have the largest mean angle at 126°·1, the Hokiens least at 121°·03, a difference of 5°, the Hylam value exceeding the Hokien by 1°·1 and the Tamil being greater than the Hokien by 1°·3.

Several indices have been calculated. The height of the ramus stated as a percentage of the total length of the mandible shows that the Hokien ratio is greatest at 64 %. The Hylam is a close second at 2·3 % less, and the Tamil and Tibetan values are respectively 57·8 and 59·42. Two breadth indices are calculated, the width of the coronoid processes in relation to the total length, and the width at the gonia as a percentage of the length of the body. Now the width of the coronia must to a great extent depend on the muscular pull of the temporal muscles, and as these muscles are placed on the side of the skull one expects the broader skulls to have the coronoid processes of the mandibles set more widely apart. As the mean total lengths are fairly close in the four series it is to be expected that the Hylam would have the highest index, the value being 95·11, and the Hokien being only 0·4 % less. The Tibetans have rather a low index at 89·8 and the Tamils a higher index than one would expect from such a narrow skull, namely 92·26. When we remember, however, that the Tamils have a much greater mean minimum frontal breadth than any of the others the anomaly is explained, for the more direct line of pull of the temporal muscles is from the anterior part of the temporal fossa. Indices have no relation to actual size, and we find that the percentage of gonial width to corporeal length is less in the Tamils than in any of the others. The ratio of ramus breadth to ramus length is remarkable for the closeness of the values for the four series, the Hokien showing the largest value, the Tamil the smallest, the difference between the two being only 2·6 %. The ratio of gonial width to coronial width in the four series differs by only 2·0 %.

The angles as indices of shape produce interesting comparisons. It is indeed surprising to find the means of the angle between ramus and body so close to one another when one remembers the various factors which may alter this angle, chief of which are age and dentition. These results offer a clear indication of the uniformity of the mandibular changes in mankind. The Tibetan shows the largest angle at 126°·1, the Hokien the lowest at 121°·0, the Hylam and Tamil being approximately equal around 122°. Here is surely an important fact: a Dravidian and a Mongolian race with equal mandibular angles. The angle *R* is in my opinion not of very great comparative value as it depends on the development of a muscular process, the coronoid. The angle *G* is the angle subtended at the gnathion and is a calculated value depending on the width of the triangle, that is the gonial axis, and the length of the sides, namely gonion to gnathion. There is an ascending series of values from Tibetan through Tamil and Hylam to Hokien. Here again the values are in pairs, Tibetan and Tamil at 67°·7 and 68°·25 respectively and Hylam and Hokien at 69°·6 and 70°·46. This pairing of Tamil with Tibetan and Hylam with Hokien appears to be one of the more outstanding features in the whole series of values.

The angle C', however, shows very wide differences in values. According to Dr Morant the angle C' is the angle which the sagittal line joining pogonion A to infradental makes with the standard basal plane, and this is the angle I have measured. As I have already stated, Dr Morant's values are obtained by calculation* while mine are taken by direct measurement. The Tibetan angle is quoted at 61°·4 which would indicate a very prominent mental protuberance. I have measured this angle as accurately as possible on the plate showing the *norma lateralis* of the Tibetan skull in Dr Morant's paper and find the angle gives a value of 71°. That an error has crept in somewhere either in Dr Morant's definition of the angle or his measurement is evident from the fact that Dr Morant quotes the value of the angle between a line joining pogonion A to intradental and the standard basal plane as 64°·4 or 3° more than the angle C' which obviously must be the larger angle†. The Hokien value for the angle C' is 77°·1, the Tamil and Hylam values being respectively 71°·03 and 72°·36. It will be apparent that the Tamil value is approximately equal to the value I obtained by measuring the photograph of the Tibetan skull.

Unfortunately in statistical or biometric work a discrepancy in one set of measurements leads to errors in other results. This is well seen in the values of the angle S which are Tibetan 35°·4, Hokien 27°·52, Hylam 26°·09 and Tamil 19°·86. The angle as given by Morant is the difference between the angle L and the angle C', so that if the latter angle is wrong then it follows that the angle S is also at fault. It will be seen that if the angle C were 71° instead of 61° the angle S would have a value of 25°, which would compare favourably with the sequence of the other values. In confirmation of my opinion that an error has arisen I have measured the angle S on the photograph in Morant's paper on the Tibetan skull. Such a measurement can of course be only a rough approximation, but I find the value so obtained is 24°‡.

* [All Prof. Harrower has stated (see p. 285) is that Dr Morant's S was obtained from his C' and L by differencing them. Actually Dr Morant's C' was obtained directly by the use of Ranke's goniometer (*Biometrika*, Vol. XIV. p. 258). The comparison of the mean of angles lying in the sagittal plane with the measurement of a not well-defined angle on a photograph of the *norma lateralis* of a single skull, where the infradental can only be guessed at and the lower border of the mandible is foreshortened, is not profitable. Judged by such a process Prof. Harrower's Hokien skull, No. 127, should have a mental angle C' of about 74°, whereas the actual measurement in his Appendix is 65°·7!—ED.]

† [This is not correct, the intradental in some races projects anteriorly beyond the infradental when the mandible is adjusted to the standard plane. The angle C is greater than the angle C' in Tibetan A (C=64°·8, C'=62°·9), Tibetan B (C=66°·7, C'=63°·1) and Nepalese (C=67°·3, C'=66°·4), but is less than the angle C' in Anglo-Saxons (C=68°·2, C'=68°·3) and Badari Egyptians (C=71°·7, C'=73°·2). —ED.]

‡ [Prof. Harrower is here, I think, repeating the error of his previous measurement on the photograph of the *norma lateralis*. We require the angle between the Frankfurt plane, and the line or axis of the standard mandible plane lying in the median sagittal section of the mandible. Now the eye of the spectator supposed in the optic axis of the camera lies *above* the standard plane. Hence if it could see the above axis, which may be supposed to be on the focal plane of the camera, it would lie well *above* the projection on this plane of the lower border of the mandible. When therefore the lower border of the mandible is taken to determine the angle between the axis of the mandible and the horizontal, it will reduce the angle S in the same way as it increases the angle C'. His criticism is, I think, invalid; it is equivalent to the assertion that an average error of 10° has been made by biometricians in reading 27 angles with a goniometer!—ED.]

The angle *F* is the total profile angle or the angle which a line joining the nasion with pogonion *B* makes with the Frankfurt horizontal. The mean values are remarkably similar. The Hokien is largest at 92°·98, the Tibetan next at 91°·7, the Hylam value is 90°·79 and the Tamil 89°·59. It will be noted that the Tamil is the only mean under 90°. The angles *L* and *L′* are the angles which a line joining the infradental and the pogonion *A* and *B* respectively make with the Frankfurt horizontal. I consider that one of these angles would be sufficient. There is a wide difference in the values of the four series, the Tibetan and Hylam values being respectively 96°·8 and 98°·73 for the angle *L*, the Hokien value being 104°·84 and the Tamil 90°·89, a maximum difference of 14°.

4. *Standard Deviations for the Characters* $100\,c_r h/ml$, $100\,c_r c_r/ml$, *and the Angles F and M.* I have calculated the standard deviations for the above characters and the results are given in Table III.

TABLE III.

Standard Deviations for the Characters $100\,c_r h/ml$, $100\,c_r c_r/ml$, *and the Angles F and M.*

Character	Hokien			Hylam			Tamil		
	S.D.	P.E.	No.	S.D.	P.E.	No.	S.D.	P.E.	No.
Angle *M* ...	5°·837	·45	38	8°·350	·80	39	7°·751	·64	33
Angle *F* ...	3°·222	·25	38	3°·293	·25	39	3°·288	·27	33
$100\,c_r h/ml$	5·140	·40	38	6·266	·48	39	6·082	·51	33
$100\,c_r c_r/ml$	7·035	·54	38	7·185	·55	39	7·763	·65	33

For the angle *M* the standard deviations are rather high, especially the Hylam at 8°·350. For the angle *F* the standard deviations are very close, the difference between the lowest, the Hokien, and the highest, the Hylam, being only 0°·07. The angle *F* is indeed a remarkably constant character, the probable error being 0°·25 only. The height-length index standard deviation is 5·140 for the Hokien, 6·082 for the Tamil, and 6·266 for the Hylam, which values are well within the range of variation one expects to find in such characters, and compares favourably with the standard deviations one obtains for the more constant characters in the skull. The standard deviation for the breadth-length index is greater, the values being 7·035 for the Hokien, 7·185 for the Hylam and 7·763 for the Tamil series. It will be seen that the Hokien mandible is least variable, the Hylam most variable in the three series. The same sequence of results was found from the skulls. The Hokien is a more stable type than either the Tamil or the Hylam.

5. *Comparison of the Profile Angle and the Total Profile Angle.* The angle *F* is the total profile angle or the angle between a line joining pogonion *B* and nasion and the Frankfurt horizontal. The profile angle is the angle which a line joining the alveolar point and nasion makes with the Frankfurt horizontal. As

Number	1	2	3	4	5	6	7	10	11	12	13	14
w_1 ...	116·2	116·0	119·2	121·1	121·0	121·6	123·8	113·8	115·1	130·1	133·6	119·8
w_2 ...	93·4	93·3	110·4	107·0	101·9	96·9	98·5	91·0	96·8	96·0	101·2	97·0
h_1 ...	32·5	35·0	31·0	31·5	35·1	35·5	34·8	37·3	32·6	34·6	33·5	40·0
zz ...	49·1	46·2	45·9	48·2	48·2	46·8	44·0	48·0	46·5	50·3	45·8	47·0
$c_r c_r$ ...	100·0	93·0	94·8	93·6	91·5	96·9	92·2	98·8	95·5	112·7	100·2	93·8
rb ...	37·0	38·6	38·2	41·1	42·1	37·0	38·5	42·0	37·5	37·6	40·0	40·5
rb' ...	34·6	31·6	32·5	37·0	33·0	33·0	34·5	39·5	31·7	33·0	37·0	36·5
G_2' ...	44·2	43·4	48·0	44·4	43·8	36·5	43·0	43·0	43·0	47·4	45·0	42·0
$c_y c_r$ ...	35·0	33·2	36·0	43·9	32·6	32·2	35·6	32·4	37·8	30·9	36·2	33·9
$g_o g_o$ ...	88·4	87·5	108·0	103·6	98·0	90·0	92·1	84·8	94·0	91·5	96·2	91·0
$g_n g_o L$ ...	84·0	79·0	82·0	83·0	78·0	81·2	80·0	83·2	76·6	78·0	84·5	87·5
$g_n g_o R$ ...	82·5	74·4	83·5	88·2	77·1	79·8	80·0	76·6	74·5	75·5	80·0	88·0
$c_y l$ ...	19·0	16·8	20·9	20·4	19·4	17·0	18·5	18·4	19·6	22·7	21·5	20·0
$c_y b$ ...	7·5	8·4	9·1	8·3	8·9	7·0	9·8	11·5	8·5	8·8	9·5	9·0
$m_2 p_1$ ...	30·0	29·8	32·2	29·2	28·2[R]	30·5	28·2	26·9[R]	28·0	32·5	—	31·6
$p_a d_1$ ...	28·0	29·8	26·4	27·0	29·1	30·5	29·0	32·0	26·4	27·0	30·8	34·1
$p_a g_n$ ...	6·5	7·5	7·2	6·5	8·5	7·5	7·5	7·5	8·4	9·2	4·5	8·0
$p_a d_f$ ...	25·3	27·5	22·0	24·0	26·8	27·5	26·3	30·1	23·8	25·1	29·8	31·8
$g_n d_f$ ...	30·0	33·0	26·9	28·4	32·6	33·0	32·2	35·4	30·0	33·2	32·6	37·5
$p_a p_b$ ...	3·0	6·5	4·7	3·6	3·2	3·7	5·0	3·9	7·5	5·0	4·0	7·2
$g_o p_a g_o$ ...	190·0	180·0	184·0	193·5	175·0	177·0	185·0	184·0	176·0	178·5	187·5	202·0
ih ...	50·3	44·0	46·7	47·9	40·1	47·5	49·0	47·0	44·5	50·7	48·8	50·8
ih' ...	13·0	11·8	13·4	13·0	10·5	15·5	10·5	12·8	14·0	17·5	13·5	15·7
$c_r h$ ...	67·7	59·6	66·3	58·4	55·5	67·8	66·2	64·0	64·0	74·2	67·5	71·5
$c_y h$ ...	60·5	50·2	55·4	66·0	45·2	57·8	55·5	55·6	53·2	63·0	60·5	62·1
$d_1 h$ ...	36·5	38·8	35·5	35·0	41·2	57·8	57·4	40·2	33·4	37·8	36·0	44·5
$m_2 h$ ...	27·5	27·2	24·6	28·5	27·0[R]	29·7	28·0	29·7[R]	27·8	32·0	29·0[R]	31·7
$p_1 h$ ...	28·0	32·2	29·3	32·4	34·5	33·4	31·2	35·4	29·5	34·0	32·0	40·0
$c_y l$ ...	76·0	68·7	68·8	73·5	76·5	72·5	71·5	75·7	65·5	67·8	73·5	82·5
rl ...	62·2	58·0	61·4	71·8	54·0	60·7	58·3	57·0	60·2	65·4	63·0	66·6
ml ...	100·5	100·8	103·0	107·4	102·0	99·0	96·0	97·8	100·5	94·5	98·8	110·8
$100\, c_r h/ml$	67·36	59·15	64·37	54·37	54·41	63·48	68·96	65·44	63·64	78·52	68·32	64·53
$100\, c_r c_r/ml$	99·50	92·26	92·04	87·15	89·70	97·88	96·04	101·02	95·02	119·26	101·42	84·66
$100\, g_o g_o/c_y l$	116·31	127·36	156·98	140·95	128·10	124·14	128·81	112·02	143·51	134·95	130·88	110·30
$100\, rb'/rl$	55·63	54·48	52·93	51·53	61·11	54·36	59·18	69·29	52·66	50·46	58·79	54·82
$100\, c_y b/c_y l$	39·47	50·00	43·54	40·69	45·88	41·18	52·97	62·50	43·37	38·76	44·19	45·00
$100\, g_o g_o/c_r c_r$	88·40	94·09	113·92	110·68	107·10	92·88	95·55	85·82	98·43	81·12	96·01	97·01
$100\, c_y h/c_r h$	89·36	84·23	83·56	113·01	81·44	85·25	83·84	86·87	83·12	84·90	89·64	86·85
$100\, ih'/c_y c_r$	37·14	35·54	37·22	29·61	32·21	48·13	29·49	39·50	37·03	56·63	37·29	46·31
$100\, d_1 h/c_r h$	53·91	65·10	53·54	59·93	74·23	85·25	86·71	62·81	52·19	50·94	53·33	62·24
Angles in degrees M ...	115·0	127·8	126·0	122·5	133·5	118·0	117·5	113·6	127·5	116·5	117·5	120·0
R ...	78·0	69·2	73·2	49·0	66·5	80·0	80·0	81·5	70·5	87·0	74·5	77·0
G ...	64·0	69·2	81·6	74·1	78·0	67·9	70·9	64·0	77·0	72·0	71·5	62·2
C' ...	80·3	80·5	76·5	75·0	68·8	80·0	84·0	83·0	77·5	86·0	80·0	71·0
L ...	99·5	112·5	105·5	92·0	108·4	106·2	114·5	110·0	107·5	104·3	112·5	105·6
L' ...	100·0	112·5	104·8	91·5	105·7	105·0	113·4	109·5	105·7	105·0	112·5	105·5
F ...	92·5	91·0	91·6	83·5	92·5	96·0	97·4	95·0	95·7	94·5	97·5	92·5
S ...	19·2	32·0	29·0	17·0	39·6	26·2	30·5	27·0	30·0	18·3	32·5	34·6

APPENDIX III.

Table of Individual Measurements for Male Hokien Mand

13	14	15	16	17	18	19	20	21	22	23	25
133·6	119·8	128·9	122·7	118·6	132·0	122·4	121·8	124·0	116·7	121·9	132·0
101·2	97·0	96·9	103·0	104·0	103·1	92·7	99·8	106·5	102·2	101·0	101·8
33·5	40·0	35·5	34·2	36·4	37·2	35·5	32·5	35·7	36·5	31·6	37·1
45·8	47·0	47·1	49·0	50·1	48·5	41·3	45·0	47·4	48·0	47·5	47·0
100·2	93·8	89·8	104·5	99·0	107·1	97·2	92·2	95·6	93·0	96·0	107·0
40·0	40·5	41·5	38·1	41·5	35·0	31·2	42·6	42·3	42·7	40·5	41·0
37·0	36·5	38·4	33·6	37·0	30·0	29·0	36·0	37·4	37·0	37·8	35·3
45·0	42·0	40·0	43·0	43·0	51·0	51·5	39·0	43·0	42·0	45·5	45·5
36·2	33·9	39·0	33·8	37·3	34·0	29·6	38·0	41·0	38·1	37·9	30·3
96·2	91·0	92·0	98·6	99·0	99·6	87·3	94·2	103·0	95·5	94·5	94·5
84·5	87·5	87·5	79·8	85·5	80·5	80·8	84·5	85·8	83·5	84·4	87·5
80·0	88·0	87·5	81·0	85·7	80·3	80·5	85·2	83·3	81·8	79·5	87·2
21·5	20·0	22·3	22·8	18·8	20·6	17·9	20·0	19·5	18·1	20·4	24·2
9·5	9·0	9·0	8·4	9·5	8·4	10·7	8·5	11·1	9·0	9·3	9·8
—	31·6	32·0	23·0	30·5	—	28·6	27·5	31·5	31·0	33·0	36·8
30·8	34·1	30·6	28·9	30·0	31·8	32·0	29·2	28·0	31·8	26·4	31·8
4·5	8·0	8·5	7·9	9·0	9·2	5·7	7·0	10·0	6·2	7·2	7·8
29·8	31·8	27·2	26·4	27·5	28·5	29·8	27·5	26·0	29·9	23·8	29·2
32·6	37·5	33·0	32·4	34·0	34·6	33·0	31·5	33·2	34·9	29·0	34·5
4·0	7·2	5·4	2·3	6·5	7·0	3·8	6·5	4·0	7·2	5·0	5·0
187·5	202·0	204·5	185·0	199·0	188·5	188·0	194·0	189·0	184·0	187·0	202·0
48·8	50·8	51·7	47·0	48·0	48·4	51·5	41·5	49·5	44·4	47·0	49·3
13·5	15·7	16·6	14·7	14·4	14·5	12·5	12·8	15·4	13·5	13·7	13·5
67·5	71·5	70·5	67·0	67·7	70·5	69·0	59·8	69·5	64·3	64·0	67·4
60·5	62·1	67·0	57·6	53·5	57·5	59·0	51·0	59·5	52·3	58·5	59·5
36·0	44·5	43·0	40·3	39·0	38·5	37·6	34·5	40·0	38·3	34·2	41·3
29·0^{R}	31·7	31·0	28·0	28·5	—	29·2	26·5	29·8	27·2	28·7	38·5
32·0	40·0	36·0	34·0	33·5	31·2	29·2	33·2	33·5	32·4	28·3	34·3
73·5	82·5	82·4	71·8	77·5	72·0	73·5	76·5	73·0	72·0	74·0	80·4
63·0	66·6	69·3	62·0	61·2	64·4	62·5	56·5	63·8	56·6	60·5	63·0
98·8	110·8	109·2	101·8	107·0	104·5	100·2	107·5	104·2	101·5	98·3	107·2
68·32	64·53	64·56	65·81	63·27	67·46	68·86	55·63	66·60	63·35	65·11	62·77
101·42	84·66	82·23	102·65	92·52	102·49	97·00	85·77	91·75	91·62	97·66	99·81
130·88	110·30	111·65	137·32	127·10	138·05	118·77	123·14	141·07	132·64	127·70	117·54
58·79	54·82	55·41	54·19	60·46	46·58	46·40	63·72	50·78	65·37	62·48	56·03
44·19	45·00	40·36	36·84	50·53	40·78	59·78	42·50	56·92	49·72	45·59	40·41
96·01	97·01	102·45	94·35	100·0	92·18	89·81	91·22	107·74	102·69	98·44	88·32
89·64	86·85	95·03	85·97	71·05	81·56	85·51	85·28	85·61	81·34	91·41	85·28
37·29	46·31	42·56	43·49	38·61	42·65	42·23	33·69	37·56	35·43	36·12	44·53
53·33	62·24	60·99	60·15	57·61	54·61	54·49	57·69	57·55	59·56	53·44	61·28
117·5	120·0	114.5	122·5	120·2	124·0	118·7	116·5	121·5	124·0	116·2	118·5
74·5	77·0	71·0	74·0	75·5	80·0	81·0	68·0	73·0	75·5	73·0	79·5
71·5	62·2	63·0	75·5	70·6	76·2	65·8	67·3	75·0	71·0	69·9	65·3
80·0	71·0	68·0	75·2	79·0	72·0	67·0	72·5	80·0	77·0	79·5	74·5
112·5	105·6	88·5	96·0	104·5	110·5	99·0	104·5	104·5	108·0	106·0	102·0
112·5	105·5	87·3	96·0	104·0	102·0	98·5	104·0	104·0	107·0	105·5	101·5
97·5	92·5	90·0	91·5	90·0	95·5	94·5	94·5	91·0	96·5	94·0	92·0
32·5	34·6	20·5	20·8	25·5	29·5	32·0	32·0	24·5	31·0	26·5	27·5

R = Measurement made on Right side.

Hokien Mandibles.

23	25	27	28	29	30	31	32
121·9	132·0	115·5	128·5	125·1	127·8	125·9	124·2
101·0	101·8	98·0	108·5	118·5	106·0	100·5	100·0
31·6	37·1	38·5	37·4	31·8	35·5	35·0	39·5
47·5	47·0	45·1	46·0	47·0	50·0	44·2	44·3
96·0	107·0	93·0	97·0	105·0	101·3	94·1	97·0
40·5	41·0	41·5	43·3	41·2	41·3	34·8	38·5
37·8	35·3	38·3	35·5	36·4	37·2	32·2	27·8
45·5	45·5	39·0	44·8	45·5	36·4	49·0	53·0
37·9	30·3	32·5	35·6	32·3	34·2	39·1	34·4
94·5	94·5	90·0	103·2	102·2	99·8	97·6	95·4
84·4	87·5	84·5	84·8	88·0	89·0	84·2	82·0
79·5	87·2	89·6	84·0	87·0	92·2	82·0	79·8
20·4	24·2	20·5	20·8	21·0	23·0	22·0	19·3
9·3	9·8	9·3	9·9	9·0	8·0	8·1	7·5
33·0	36·8	29·5	27·5	29·8	34·4	—	—
26·4	31·8	30·7	30·3	26·8	30·7	29·0	36·2
7·2	7·8	10·5	9·0	7·8	7·8	7·5	5·0
23·8	29·2	29·0	28·9	24·6	28·2	28·0	33·9
29·0	34·5	36·0	35·5	29·7	33·5	34·0	37·0
5·0	5·0	5·0	4·8	5·3	4·3	6·5	7·3
187·0	202·0	207·5	190·0	199·5	213·0	187·0	182·5
47·0	49·3	49·0	49·5	45·5	52·3	48·6	37·5
13·7	13·5	9·0	12·5	15·0	16·0	13·5	13·8
64·0	67·4	60·8	70·0	69·0	75·0	64·4	61·8
58·5	59·5	57·5	56·2	54·5	63·3	63·0	42·7
34·2	41·3	42·5	40·3	33·5	42·0	37·5	42·0
28·7	38·5	30·0	31·7	26·3	30·0	—	—
28·3	34·3	37·7	30·7	29·8	35·4	32·0	36·3
74·0	80·4	85·0	73·5	71·0	82·0	73·0	68·0
60·5	63·0	58·1	59·7	58·5	67·0	65·4	56·3
98·3	107·2	105·5	102·0	103·0	109·0	97·8	111·0
65·11	62·77	57·63	68·63	66·02	68·81	65·85	55·67
97·66	99·81	88·15	95·09	101·94	92·93	96·24	87·39
127·70	117·54	105·88	140·41	143·94	121·71	133·69	140·29
62·48	56·03	65·92	59·46	62·22	55·52	49·24	49·38
45·59	40·41	45·36	47·59	42·86	34·78	36·82	38·86
98·44	88·32	96·77	106·39	97·33	98·52	103·72	98·35
91·41	85·28	94·57	80·28	78·98	84·40	97·83	68·11
36·12	44·55	27·69	35·11	46·44	46·78	34·53	40·11
53·44	61·28	69·90	57·57	48·55	56·00	58·23	67·96
116·2	118·5	113·8	122·0	116·0	117·5	114·5	140·5
73·0	79·5	73·0	82·5	90·0	81·5	72·3	72·5
69·9	65·3	62·2	75·2	71·4	66·9	71·8	72·1
79·5	74·5	77·0	78·5	76·5	74·0	79·0	69·0
106·0	102·0	104·5	111·5	102·0	94·0	104·0	109·0
105·5	101·5	103·5	113·0	102·5	95·0	105·0	111·0
94·0	92·0	91·5	100·0	91·5	87·0	93·0	95·5
26·5	27·5	27·5	33·0	25·5	20·0	25·5	40·0

side.

	30	31	32	33	34	36	37	38	39	40	90	99	142
1	127·8	125·9	124·2	110·5	113·2	119·5	132·0	118·5	120·0	115·5	122·9	120·8	121·5
5	106·0	100·5	100·0	102·2	99·0	98·8	104·0	99·8	100·3	101·3	106·1	98·0	100·8
8	35·5	35·0	39·5	33·0	34·4	34·0	37·2	36·8	32·5	40·2	35·0	36·4	34·5
0	50·0	44·2	44·3	41·5	44·2	47·3	47·1	46·8	47·8	48·0	49·2	44·1	50·0
0	101·3	94·1	97·0	91·6	96·1	91·4	95·0	90·8	96·3	100·5	97·0	98·8	103·2
2	41·3	34·8	38·5	35·2	37·5	35·6	41·0	42·0	40·0	39·7	41·2	40·5	35·8
4	37·2	32·2	27·8	27·5	33·6	28·3	37·2	35·5	35·6	34·0	36·0	34·5	32·8
5	36·4	49·0	53·0	42·5	34·5	44·5	44·0	42·0	44·5	42·0	45·5	46·5	45·5
3	34·2	39·1	34·4	33·5	34·4	35·3	37·5	35·5	37·0	34·3	36·2	37·5	38·5
2	99·8	97·6	95·4	96·4	95·6	94·0	99·8	93·6	94·0	95·2	99·7	92·7	94·4
0	89·0	84·2	82·0	81·2	81·2	78·0	87·0	85·8	84·2	80·5	85·2	79·5	85·0
0	92·2	82·0	79·8	81·2	79·0	76·8	86·0	87·0	85·2	80·0	85·2	78·5	83·0
0	23·0	22·0	19·3	14·8	17·6	20·0	23·6	20·6	20·6	19·5	20·8	20·3	18·8
0	8·0	8·1	7·5	7·2	8·4	7·0	8·8	9·5	8·8	8·5	8·0	10·2	8·2
8	34·4	—	—	30·0	29·9	30·8	31·0	28·8	29·5	29·0	33·2	—	31·8
8	30·7	29·0	36·2	27·9	29·2	30·2	31·5	31·8	28·0	34·3	31·0	32·8	27·2
8	7·8	7·5	5·0	7·0	6·4	4·6	7·0	6·8	8·1	8·1	7·0	5·4	9·8
6	28·2	28·0	33·9	24·0	25·8	28·5	29·5	28·8	25·2	31·0	29·3	31·0	24·8
7	33·5	34·0	37·0	29·5	30·6	32·2	34·8	33·5	31·0	37·3	33·5	35·0	32·5
3	4·3	6·5	7·3	7·1	5·1	6·6	4·8	3·5	7·0	6·5	5·6	8·4	2·2
5	213·0	187·0	182·5	185·0	182·5	176·0	196·0	198·5	196·0	189·0	200·5	181·0	194·5
5	52·3	48·6	37·5	42·4	46·7	40·8	50·5	47·8	46·2	50·4	41·6	46·5	51·0
0	16·0	13·5	13·8	10·4	15·5	13·5	15·6	13·8	14·5	11·0	12·6	13·5	15·0
0	75·0	64·4	61·8	56·5	68·5	60·8	69·5	64·5	64·0	69·9	66·9	62·2	67·5
5	63·3	63·0	42·7	49·0	56·3	47·0	64·0	60·8	58·9	54·5	46·5	59·7	64·5
5	42·0	37·5	42·0	36·8	37·5	38·0	42·3	41·7	34·5	44·0	39·4	37·7	38·0
3	30·0	—	—	25·5	25·6	23·5	27·5	29·2	27·3	31·7	27·2	—	28·4
8	35·4	32·0	36·3	31·6	33·0	31·2	32·6	35·1	32·0	38·0	33·0	31·5	30·5
0	82·0	73·0	68·0	70·0	69·0	64·0	76·6	76·2	76·5	70·5	77·0	69·0	75·8
5	67·0	65·4	56·3	55·8	62·0	56·6	66·6	66·3	61·9	58·0	53·4	64·8	67·0
0	109·0	97·8	111·0	100·5	103·0	101·8	102·0	110·8	104·7	96·0	103·4	103·5	101·0
02	68·81	65·85	55·67	56·22	66·50	59·72	68·14	58·21	61·13	72·81	64·70	60·00	66·83
94	92·93	96·24	87·39	91·14	93·30	89·78	93·14	81·94	91·98	104·69	93·81	95·46	102·18
94	121·71	133·69	140·29	137·71	138·55	146·87	130·29	122·83	122·87	135·03	129·48	134·35	124·54
22	55·52	49·24	49·38	49·28	54·19	50·00	55·86	53·54	57·51	58·62	67·41	53·24	48·95
86	34·78	36·82	38·86	48·65	47·73	35·00	37·37	46·12	42·72	43·59	38·46	50·25	43·62
33	98·52	103·72	98·35	106·33	99·48	102·84	105·05	103·08	97·61	94·73	102·78	93·82	91·47
98	84·40	97·83	68·11	86·72	82·04	77·30	92·09	94·26	92·03	77·96	69·51	95·98	95·55
41	46·78	34·53	40·11	31·04	45·06	38·24	41·60	38·87	39·11	32·07	34·81	36·00	38·97
55	56·00	58·23	67·96	65·13	54·74	62·50	60·86	64·65	53·91	62·95	58·89	60·61	56·29
0	117·5	114·5	140·5	127·5	124·5	132·0	117·0	124·5	119·0	119·0	120·8	123·0	115·5
0	81·5	72·3	72·5	65·5	76·5	70·4	72·6	62·5	69·0	88·5	93·0	61·5	71·0
4	66·9	71·8	72·1	72·9	73·0	74·8	70·0	65·7	67·2	72·8	71·5	69·9	68·3
5	74·0	79·0	69·0	81·0	77·0	75·5	80·5	76·5	72·5	84·5	73·0	86·5	81·5
0	94·0	104·0	109·0	112·0	101·0	107·5	104·5	100·0	100·0	117·5	106·0	105·5	103·2
5	95·0	105·0	111·0	110·0	101·5	109·5	104·5	101·0	99·5	120·0	105·5	105·5	103·0
5	87·0	93·0	95·5	95·0	91·5	94·5	94·0	87·0	93·5	96·5	94·0	87·5	92·0
5	20·0	25·5	40·0	31·0	24·0	32·0	24·0	23·5	27·5	33·0	33·0	19·0	21·5

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Number	*41*	*42*	*44*	*45*	*46*	*47*	*48*	*49*	*50*	*51*	*52*	*54*	*5*
w_1 ...	126·8	115·1	120·6	116·7	113·2	119·2	123·5	119·5	116·0	119·5	120·0	111·0	12
w_2 ...	94·0*	98·7	103·0	95·3	97·0	102·0	105·0	88·7	83·0	85·1	94·0	100·8	10
h_1 ...	29·0	29·4	30·3	26·5	24·5	27·0	29·5	34·0	29·7	29·0	29·5	34·5	3
zz ...	46·2	43·4	45·5	45·0	45·2	47·4	50·5	44·6	45·8	41·5	43·0	49·2	4
$c_r c_r$ ...	93·2	91·8	93·0	99·8	91·2	96·8	108·0	89·8	92·0	91·0	92·2	88·3	10
rb ...	32·8	33·0	39·4	31·5	34·5	36·3	33·8	35·0	30·8	29·5	37·0	43·5	4
rb' ...	31·7	30·2	34·8	30·0	30·2	31·5	26·2	30·3	26·3	23·0	36·0	36·0	3
G_2' ...	43·5	35·0	42·0	48·4	43·5	45·7	54·0	40·3	40·5	42·5	42·7	35·3	4
$c_y c_r$ ...	36·6	32·0	42·3	29·5	31·6	34·8	34·4	34·0	29·3	28·0	38·7	37·8	3
$g_o g_o$ ...	98·1*	94·5	101·0	93·2	95·5	98·8	101·4	82·5	79·7	82·0	91·3	98·7	9
$g_n g_o L$ ...	82·0	88·2	84·9	74·4	83·2	85·0	78·0	80·1	76·0	73·4	85·3	79·0	8
$g_n g_o R$ ...	83·2	89·0	88·8	74·8	81·4	87·0	81·0	77·6	77·4	76·0	85·0	74·0	8
$c_y l$ ...	19·2	18·9	21·5	18·8	16·7	20·2	20·5	19·0	21·4	16·3	18·0	19·4	2
$c_y b$ ...	9·3	9·1	9·3	10·2	8·5	10·2	8·2	7·5	7·5	6·8	9·0	9·3	
$m_2 p_1$ ...	30·2	30·3	31·0	28·9	29·7	32·1	28·4	31·0	29·5	27·6	29·0	29·2	3
$p_a d_t$ ...	24·2	23·0	22·4	17·3	22·8	23·0	27·4	27·2	24·1	26·2	25·0	26·5	2
$p_a g_a$ ...	8·8	9·5	10·9	10·4	4·0	6·8	5·0	8·7	8·1	6·4	8·0	12·7	1
$p_a d_f$ ...	20·6	19·5	19·9	15·5	20·9	19·2	22·7	24·6	20·2	22·2	20·8	20·5	2
$g_n d_f$ ...	25·8	26·0	27·5	25·5	22·7	23·7	25·6	30·5	26·2	27·0	26·4	30·0	3
$p_a p_b$ ...	2·1	1·8	2·3	1·9	4·0	2·3	2·8	2·7	3·3	3·8	1·8	5·8	
$g_o p_a g_o$ ...	181·5	200·0	184·0	168·5	186·0	183·5	181·5	186·0	181·5	175·0	193·0	187·0	19
ih ...	52·3	42·7	43·6	52·6	40·8	42·6	39·8	50·2	44·2	36·2	47·7	40·6	4
ih' ...	14·0	12·0	13·2	12·0	9·5	15·0	16·3	13·0	14·0	9·8	11·8	12·1	1
$c_r h$ ...	67·4	54·8	60·4	64·9	53·2	61·0	64·8	67·7	60·2	50·0	57·3	61·4	6
$c_y h$ ...	65·2	55·3	52·8	64·9	48·4	53·7	59·0	58·8	57·8	42·5	63·0	43·0	6
$d_t h$ ...	34·2	33·4	34·0	28·3	33·4	33·5	31·0	38·3	34·7	34·2	33·5	35·0	3
$m_2 h$ ...	24·7	23·4	23·7	25·9	23·0	24·0	21·7	26·4	24·6	19·5	27·3	27·7	2
$p_1 h$ ...	27·6	25·5	28·5	25·7	29·6	26·5	22·8	31·6	25·5	28·0	27·3	31·0	3
$c_y l$ ...	77·0	82·5	75·7	65·9	72·5	75·7	65·2	74·5	72·3	67·2	80·2	69·0	7
rl ...	68·0	56·7	60·7	65·0	53·3	58·0	58·1	64·0	61·5	52·0	63·5	50·0	6
ml ...	101·5	105·6	110·0	83·8	101·0	105·8	100·5	102·5	103·5	100·4	99·8	101·5	9
$100\, c_r h/ml$	66·40	51·89	54·10	77·45	52·67	57·65	64·48	66·05	58·16	49·80	57·51	60·49	6
$100\, c_r c_r/ml$	91·82	86·93	84·54	119·09	90·29	91·49	107·46	87·60	88·89	90·64	92·38	86·99	10
$100\, g_o g_o/c_y l$	127·40	114·54	133·42	141·41	131·72	130·51	155·52	110·74	110·23	122·02	113·84	143·04	12
$100\, rb/rl$	46·62	53·61	57·33	46·15	56·66	52·59	45·09	47·34	41·22	44·23	56·69	72·00	5
$100\, c_y b/c_y l$	48·44	48·15	43·25	54·25	50·89	50·49	40·00	39·47	35·05	41·71	50·00	47·94	3
$100\, g_o g_o/c_r c_r$	105·26	102·94	108·60	93·39	104·71	102·07	93·89	91·87	86·64	90·11	99·02	111·78	9
$100\, c_y h/c_r h$	96·74	100·91	87·42	100·00	90·97	88·03	91·05	86·85	96·01	85·00	109·95	70·03	9
$100\, ih'/c_y c_r$	38·25	37·50	31·20	40·67	30·06	43·10	47·38	38·23	47·78	35·00	30·49	32·01	4
$100\, d_t h/c_r h$	50·76	60·95	56·29	43·60	62·78	54·92	47·84	56·57	57·64	68·40	58·46	57·00	5
Angles in degrees M ...	114·5	116·8	130·0	108·0	125·5	124·0	134·0	119·0	122·8	135·5	109·5	128·5	11
R ...	70·6	64·5	61·7	72·0	64·5	70·0	78·0	75·0	63·0	62·3	64·0	80·5	7
G ...	72·4	63·2	70·3	77·0	70·0	69·4	78·0	63·2	63·8	65·7	65·0	79·8	7
C' ...	68·5	67·8	65·7	83·0	66·0	67·5	70·5	71·0	71·5	71·0	69·0	79·0	8
L ...	81·7	86·0	87·2	92·0	84·5	85·5	94·0	94·0	90·5	94·0	84·5	104·5	10
L' ...	80·3	84·3	86·0	92·0	83·0	82·5	95·0	94·0	90·0	92·5	83·5	105·5	11
F ...	90·0	83·0	90·0	95·0	85·5	90·0	93·5	91·0	90·0	82·0	89·0	93·5	9
S ...	13·2	18·2	21·5	9·0	18·5	18·0	23·5	23·0	19·0	23·0	15·5	25·5	1

[* There appears some error in the values of

APPENDIX II.

Table of Individual Measurements for Male Tamil Mandibles.

54	55	56	58	59	60	61	62	63	64	65	68	69	70	
111·0	124·8	112·3	119·2	121·1	114·9	115·3	113·4	125·2	109·7	104·1	122·2	118·4	113·9	
100·8	102·0	89·8	96·3	101·0*	87·5	101·0	88·0	104·1	98·3	86·0	98·2	95·5	86·3	
34·5	35·2	30·5	26·5	33·3	32·5	30·0	25·5	26·5	33·0	27·5	33·0	29·0	35·7	
49·2	47·0	44·2	43·4	45·5	42·6	47·5	43·2	45·4	42·7	45·0	46·8	45·5	43·5	
88·3	101·2	87·6	94·9	94·3	99·3	101·0	92·1	104·0	92·5	93·0	94·8	95·7	91·5	
43·5	40·0	35·3	34·8	41·0	35·7	34·6	33·0	34·0	35·0	31·4	37·7	37·0	41·7	
36·0	37·5	32·0	32·9	36·0	31·3	31·0	31·4	27·2	31·0	29·1	30·8	33·5	33·0	
35·3	41·0	43·0	41·5	39·6	38·0	43·3	42·7	49·4	42·5	46·2	47·0	44·0	39·7	
37·8	38·3	35·3	35·3	33·6	30·8	24·2	34·7	34·5	31·6	31·0	37·8	39·0	37·4	
98·7	99·0	85·1	93·9	101·0*	82·3	97·2	84·8	102·5	94·6	80·0	95·3	88·0	81·2	
79·0	84·7	80·6	82·4	86·2	77·3	87·5	80·5	88·0	81·0	79·0	81·5	84·6	85·2	
74·0	84·0	84·2	83·1	84·2	79·5	85·8	77·0	84·0	82·0	76·2	82·0	83·2	83·0	
19·4	20·3	19·0	20·3	20·0	20·1	18·6	20·2	20·4	19·0	19·5	18·6	20·4	19·0	
9·3	8·1	8·2	8·0	10·0	8·8	7·1	8·8	7·0	9·3	7·2	7·1	9·5	9·5	
29·2	30·2	28·2	27·3	28·0	26·6	29·2	29·4	28·0	29·2	30·6	31·0	30·0	27·1	
26·5	26·5	25·5	22·5	28·8	27·2	26·5	18·0	27·1	25·0	24·2	29·0	24·0	29·4	
12·7	10·5	6·9	6·3	8·0	8·0	7·4	9·0	3·8	10·0	5·0	5·9	8·0	8·5	
20·5	24·0	22·0	19·5	24·9	21·9	22·0	15·8	22·0	21·8	20·0	25·5	21·0	25·8	
30·0	33·0	27·0	24·0	30·0	29·8	26·0	23·0	23·0	29·8	24·0	30·5	26·5	31·5	
5·8	4·4	3·2	3·0	4·4	4·0	4·4	1·3	3·6	3·6	5·2	8·7	4·2	4·2	
187·0	193·0	188·5	185·0	191·5	177·5	199·0	179·0	191·0	190·0	179·5	185·0	193·0	196·0	1
40·6	49·3	42·0	47·3	47·5	42·8	46·0	46·6	39·5	47·4	41·5	44·2	47·0	41·0	
12·1	16·3	12·0	13·0	13·5	14·1	12·3	12·5	13·8	13·0	13·2	13·8	17·2	12·0	
61·4	65·5	53·8	61·2	67·0	61·0	61·5	60·5	58·8	62·5	54·1	62·0	65·0	54·2	
43·0	63·5	53·8	58·0	54·5	53·1	53·0	57·5	44·0	56·5	53·0	53·2	62·0	49·7	
35·0	38·0	33·5	29·6	35·6	33·2	35·1	28·8	30·7	38·7	32·2	38·4	34·5	42·2	
27·7	28·2	24·4	24·0	25·8	26·0	28·0	21·5	20·8	26·0	20·4	24·6	20·2	28·6	
31·0	31·5	27·2	24·9	29·4	27·7	31·0	22·4	23·5	32·4	23·6	30·8	29·7	36·0	
69·0	77·8	76·6	76·0	74·8	72·8	77·3	72·3	73·8	74·0	72·8	71·5	77·6	80·2	
50·0	64·6	55·7	60·2	59·3	55·5	56·2	58·8	56·3	61·8	56·2	63·4	65·0	56·6	
101·5	99·0	100·0	98·0	105·8	97·3	104·0	94·5	111·8	107·4	96·8	109·8	109·2	111·8	1
60·49	66·16	53·80	62·45	63·33	62·69	59·13	64·02	52·52	58·12	55·89	56·47	51·85	48·47	
86·99	102·22	87·60	96·84	89·13	102·05	97·11	97·46	93·02	86·13	96·07	86·34	87·64	81·84	
143·04	127·25	111·09	123·55	135·03	113·05	125·74	116·46	138·89	127·84	109·89	133·29	113·40	101·25	1
72·00	58·05	57·45	54·65	60·71	56·39	55·16	53·40	48·31	50·16	51·76	48·58	51·54	58·44	
47·94	39·90	43·16	39·49	50·00	43·78	38·17	43·56	34·31	48·95	36·92	38·17	46·57	50·00	
111·78	97·83	97·15	98·95	107·10	82·88	96·24	92·07	98·59	102·27	86·02	100·53	91·95	88·74	
70·03	96·95	100·00	94·77	81·34	87·05	86·18	95·04	74·83	90·40	97·97	85·81	95·38	91·69	
32·01	42·56	33·99	36·83	40·18	45·78	50·83	36·02	40·00	41·14	42·58	36·51	44·10	32·08	
57·00	58·01	62·27	48·37	53·13	54·43	57·07	47·60	52·21	61·92	59·52	61·93	53·08	77·86	
128·5	112·2	118·5	115·5	124·0	119·0	122·0	114·8	137·5	125·5	117·0	132·0	122·5	130·5	1
80·5	72·2	63·0	71·0	79·0	77·5	79·5	72·0	69·5	67·5	66·5	63·0	63·5	57·5	
79·8	72·2	62·7	68·5	71·5	63·0	68·4	65·0	73·2	71·0	61·5	72·2	63·3	57·4	
79·0	89·5	68·0	73·0	70·5	70·5	65·0	73·5	53·0	75·0	67·3	74·5	65·0	69·5	
104·5	109·0	87·0	88·5	89·5	94·5	91·0	86·0	81·5	94·5	87·0	94·5	79·0	92·5	
105·5	111·5	87·0	87·5	87·5	93·5	88·5	86·0	80·5	95·5	82·5	94·5	76·0	92·5	
93·5	94·5	89·0	91·5	89·0	93·5	90·0	87·5	93·0	85·0	91·0	84·5	83·5	90·0	
25·5	19·5	19·0	15·5	19·0	24·0	26·0	12·5	28·5	19·5	19·7	20·0	14·0	23·0	

he values of w_2 and $g_o g_o$; as w_2 must be greater than $g_o g_o$ this may affect the two indices $100\, g_o g_o / c_p l$ and $100\, g_o g_o / c_r c_r$.
In skull No. 59 $w_2 = g_o g_o$ which seems improbable.—Ed.]

69	70	71	72	73	74	76	77	78	80
118·4	113·9	120·2	112·6	121·7	116·0	120·1	115·5	119·0	123·6
95·5	86·3	99·3	94·6	97·6	95·5	103·8	84·3	94·2	97·5
29·0	35·7	29·5	33·0	35·6	24·0	30·0	28·5	33·5	29·6
45·5	43·5	47·2	44·2	47·5	43·7	45·8	45·0	49·5	48·5
95·7	91·5	95·5	95·5	103·8	89·5	96·8	82·4	95·0	92·0
37·0	41·7	36·8	36·8	39·4	35·6	40·3	37·6	36·6	36·0
33·5	33·0	33·0	29·5	37·0	30·0	31·5	31·2	35·0	34·5
44·0	39·7	42·5	41·5	43·6	42·2	43·6	38·5	43·6	41·3
39·0	37·4	36·2	32·2	33·0	35·0	33·5	39·7	34·3	35·2
88·0	81·2	95·3	88·9	93·0	93·7	96·5	79·5	90·0	93·4
84·6	85·2	87·0	80·4	85·0	84·0	80·4	74·0	83·5	79·3
83·2	83·0	83·4	81·2	86·0	83·4	80·4	70·6	85·1	79·8
20·4	19·0	18·5	20·0	21·5	21·0	19·0	16·0	20·4	21·5
9·5	9·5	10·0	7·0	9·1	9·0	7·3	8·4	10·2	9·4
30·0	27·1	28·0	26·8	28·3	29·5	27·6	28·6	29·4	28·6
24·0	29·4	24·2	30·3	26·5	21·0	24·4	22·9	26·0	21·2
8·0	8·5	8·7	4·9	12·4	7·2	7·8	7·8	10·7	10·8
21·0	25·8	20·0	27·5	23·0	18·5	21·0	19·5	24·0	18·2
26·5	31·5	26·0	30·5	32·5	21·5	27·5	26·5	30·4	26·5
4·2	4·2	2·8	5·8	2·5	4·8	4·4	4·2	4·6	1·9
193·0	196·0	196·0	185·0	198·0	191·0	183·0	168·0	199·0	187·0
47·0	41·0	45·7	44.0	49·3	43·0	41·5	39·2	51·8	48·4
17·2	12·0	13·3	15·0	15·6	14·0	16·4	14·0	12·5	16·2
65·0	54·2	63·2	66·4	67·3	59·2	66·2	56·6	65·3	63·6
62·0	49·7	54·0	52·8	62·0	52·5	48·0	48·7	63·0	63·4
34·5	42·2	36·2	37·5	40·6	28·0	36·2	34·2	35·3	32·9
20·2	28·6	23·5	24·5	27·5	21·2	24·6	23·5	30·2	27·0
29·7	36·0	30·0	30·8	32·2	26·4	29·5	29·0	31·8	31·4
77·6	80·2	78·5	71·5	82·5	77·0	70·0	65·2	82·0	74·0
65·0	56·6	58·8	58·0	63·0	59·5	55·5	55·0	63·5	65·6
109·2	111·8	109·5	105·2	102·2	111·8	102·5	98·5	102·0	98·8
51·85	48·47	57·72	63·12	65·85	52·18	64·58	57·46	64·02	64·39
87·64	81·84	87·21	90·78	101·56	80·05	93·46	83·66	93·14	93·12
113·40	101·25	121·40	124·33	112·73	121·69	137·86	121·93	109·76	126·22
51·54	58·44	56·12	50·86	58·73	50·42	56·76	56·73	55·12	52·59
46·57	50·00	54·05	35·00	42·32	42·86	38·42	52·50	50·00	43·72
91·95	88·74	99·79	93·09	89·59	104·69	99·68	96·48	94·74	101·52
95·38	91·69	85·44	79·52	92·12	88·68	72·20	86·04	96·48	99·68
44·10	32·08	36·74	46·58	47·27	40·00	48·95	35·26	36·44	46·02
53·08	77·86	57·28	56·47	60·33	47·29	54·69	60·42	54·06	51·73
122·5	130·5	126·5	128·0	112·0	128·0	128·5	129·5	112·0	114·5
63·5	57·5	70·0	78·0	77·5	64·0	85·0	64·5	74·0	66·7
63·3	57·4	67·3	66·6	65·1	67·9	74·0	68·0	63·5	72·0
65·0	69·5	68·0	68·0	73·0	61·5	74·8	79·5	76·3	78·0
79·0	92·5	90·5	94·0	89·0	81·0	100·0	105·0	96·0	91·0
76·0	92·5	88·0	94·0	89·0	77·0	101·0	103·5	96·0	91·0
83·5	90·0	91·0	93·0	88·0	88·5	90·0	92·5	91·0	88·0
14·0	23·0	22·5	26·0	16·0	19·5	25·2	25·5	19·7	13·0

00 $g_o g_o / c_v e_v$.

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Number		*85*	*89*	*91*	*93*	*94*	*95*	*96*	*97*	*98*	*100*	*102*	*1*
w_1	...	112·6	117·5	124·2	124·4	124·2	129·7	132·0	124·0	123·0	123·4	123·2	11
w_2	...	91·5	91·7	102·6	99·0	98·0	111·2	101·0	104·5	99·9	92·0	101·0	9
h_1	...	25·0	33·0	30·2	37·2	37·5	35·0	35·4	33·5	32·0	35·0	33·1	3
zz	...	44·0	46·2	49·0	46·0	46·6	46·0	50·8	48·0	49·4	49·5	46·0	4
$c_r c_r$	...	95·0	95·0	104·2	103·8	96·2	104·4	99·3	103·8	96·8	103·9	91·3	9
rb	...	30·5	39·0	39·0	41·1	39·2	34·6	37·8	40·5	41·8	42·8	42·4	4
rb'	...	24·0	34·6	32·8	37·5	33·1	27·0	36·0	29·0	34·3	38·0	36·8	3
G_2'	...	49·1	43·9	52·1	43·0	47·6	—	46·9	48·0	43·0	50·1	—	4
$c_y c_r$	...	30·2	42·0	31·0	35·2	35·0	34·0	36·3	28·5	31·8	39·5	36·5	3
$g_o g_o$	...	86·4	87·1	100·0	92·0	92·0	107·5	93·5	100·0	93·5	86·5	93·5	9
$g_n g_o L$	...	79·3	79·6	89·3	84·3	85·2	80·0	88·6	84·0	83·2	93·4	82·5	8
$g_n g_o R$	...	81·0	80·7	86·9	82·1	82·1	84·7	84·0	84·9	83·0	92·1	83·0	8
$c_y l$	...	18·9	18·2	20·5	20·5	22·0	19·5	21·0	21·2	21·3	21·5	20·2	1
$c_y b$	...	6·3	7·3	7·2	9·8	8·2	8·0	11·0	10·3	9·5	9·5	10·0	
$m_2 p_1$	...	27·6	29·0	31·0	30·1	28·9	31·5	28·4	28·7	27·9	31·0	27·0[R]	2
$p_a d_t$	...	21·8	27·8	25·6	28·7	31·9	25·6	26·9	28·5	26·0	30·3	29·2	3
$p_a g_n$	...	5·5	6·1	8·0	10·0	7·0	10·0	12·8	7·0	9·0	7·5	7·8	
$p_a d_f$	...	20·6	26·0	23·0	25·9	30·0	22·4	24·5	26·0	23·9	28·6	27·0	3
$g_n d_f$	...	23·5	30·7	28·5	34·7	35·1	31·5	33·1	30·7	29·5	33·0	32·0	3
$p_a p_b$	...	2·2	4·3	5·2	3·7	5·5	6·1	1·3	5·2	6·2	7·8	5·2	
$g_o p_a g_o$	...	188·0	185·5	188·5	184·0	193·0	188·0	204·0	192·0	194·5	220·0	191·0	19
ih	...	42·0	46·7	42·2	52·3	51·4	41·0	56·8	30·5	37·1	48·7	47·5	3
ih'	...	15·6	17·2	15·4	18·1	16·4	15·0	16·7	16·0	15·3	13·5	14·9	1
$c_r h$	...	62·1	68·8	61·6	72·8	74·2	59·4	74·6	48·5	57·6	64·1	67·0	6
$c_y h$	...	45·5	58·0	51·0	66·6	57·7	48·4	73·0	40·0	45·5	60·2	54·4	5
$d_t h$	...	25·6	38·0	38·7	40·5	39·5	37·0	41·8	41·0	36·3	40·6	37·5	4
$m_2 h$	...	22·5	31·7	22·3	32·0	29·4	23·5	33·0	23·8	24·4	28·5	29·0	2
$p_1 h$	...	25·8	34·4	29·5	36·0	30·3	30·6	37·6	34·0	30·5	34·7	31·8[R]	3
$c_y l$	...	71·0	72·0	78·4	76·4	75·6	66·0	89·0	71·0	75·5	89·8	75·0	7
rl	...	58·0	64·0	57·2	69·7	64·5	59·8	73·5	51·7	51·3	65·0	60·3	6
ml	...	109·5	103·0	109·0	102·6	109·5	105·8	111·6	104·8	105·0	119·0	106·2	11
$100\, c_r h/ml$		56·71	66·79	56·51	70·95	67·76	56·14	66·84	46·28	54·86	53·89	63·09	5
$100\, c_r c_r/ml$		86·76	92·23	95·59	101·17	87·85	98·68	88·98	99·04	92·19	87·31	85·19	8
$100\, g_o g_o/c_y l$		121·68	120·97	127·55	120·42	121·69	162·88	105·06	140·84	123·84	96·32	124·67	11
$100\, rb'/rl$		41·38	54·06	57·34	53·80	51·32	45·75	48·98	55·89	66·86	58·46	61·03	5
$100\, c_y b/c_y l$		33·33	40·11	35·12	47·80	37·27	41·02	52·38	48·58	44·60	44·19	49·50	4
$100\, g_o g_o/c_r c_r$		90·95	91·68	95·97	88·63	95·63	102·96	94·16	96·34	96·59	83·25	102·41	9
$100\, c_y h/c_r h$		73·27	84·30	82·79	91·48	77·76	81·48	97·85	82·48	78·99	93·91	81·19	8
$100\, ih'/c_y c_r$		51·32	40·95	49·68	51·42	46·86	44·12	46·00	56·14	48·11	34·20	40·82	4
$100\, d_t h/c_r h$		41·22	55·23	62·82	55·63	53·23	62·29	56·03	84·54	63·02	63·34	56·97	6
Angles in degrees	M ...	134·0	122·0	126·1	114·5	124·5	134·0	109·5	140·0	127·5	118·0	124·0	12
	R ...	76·8	74·1	74·0	77·5	83·5	67·0	74·5	57·5	72·6	67·0	77·2	6
	G ...	65·1	65·5	69·1	67·1	66·4	81·2	65·7	72·6	68·2	55·9	68·9	6
	C' ...	53·0	78·5	60·8	88·0	73·0	73·0	62·5	60·0	64·0	69·2	63·0	7
	L ...	77·0	100·5	93·0	109·0	108·0	103·0	84·0	97·0	92·5	97·5	87·0	10
	L' ...	77·0	100·0	94·0	110·0	106·5	103·0	84·0	98·5	92·0	95·5	86·0	10
	F' ...	83·5	92·0	88·0	91·0	92·0	88·5	85·0	90·5	88·5	87·0	87·0	8
	S ...	24·0	22·0	32·2	21·0	25·0	30·0	22·0	37·0	28·5	26·3	24·0	2

APPENDIX I.

Table of Individual Measurements for Male Hylam Mandibl

103	*104*	*105*	*108*	*110*	*112*	*113*	*114*	*115*	*116*	*117*	*118*
13·2	117·6	114·5	125·7	124·6	117·0	118·0	129·0	119·0	120·8	125·2	118·0
94·3	106·7	95·2	98·6	92·1	91·6	93·2	105·8	99·5	100·0	99·0	104·0
37·8	31·1	33·4	35·2	31·9	31·0	35·6	32·2	32·1	32·3	35·8	34·2
46·0	45·5	46·4	46·4	45·1	42·0	44·2	44·2	50·4	46·0	48·0	47·2
98·7	97·0	91·0	102·2	101·9	89·7	95·1	108·3	100·6	92·0	100·7	91·5
40·8	39·6	39·6	42·0	37·0	36·5	34·5	40·2	36·1	39·0	40·1	40·6
34·1	34·6	26·2	36·5	33·5	32·5	30·2	34·5	34·1	33·0	36·0	35·1
48·4	48·0	47·8	43·5	48·5	43·5	47·2	48·3	45·5	—	45·5	47·0
32·6	35·8	29·2	36·4	37·3	32·2	34·0	34·8	31·0	39·2	33·0	37·4
90·5	99·5	92·0	96·0	87·0	87·0	88·0	101·0	95·0	90·0	93·0	100·5
85·2	86·4	77·1	87·1	78·3	75·0	79·0	85·1	78·0	82·5	82·8	84·9
84·3	87·2	76·2	88·3	78·6	73·5	80·5	88·2	81·0	84·2	82·8	82·0
19·5	17·3	19·0	22·5	17·1	19·0	20·3	20·6	16·5	18·0	19·0	19·6
8·6	8·5	7·0	8·5	8·0	9·0	9·2	10·1	11·1	6·6	7·0	9·0
29·5	22·6	28·5	28·8	28·2	29·2	28·2^{R}	28·2	31·0	28·9	27·0	29·4
32·5	28·0	29·6	28·1	22·7	26·1	29·0	27·8	24·7	27·5	27·9	28·0
7·0	9·0	6·2	9·0	10·0	7·0	7·5	6·0	9·5	7·5	10·0	7·8
30·3	26·7	27·8	26·9	21·5	24·5	25·6	26·7	21·9	24·6	27·2	26·5
35·1	30·6	31·0	33·5	30·2	29·7	32·0	31·2	29·5	29·5	35·0	32·8
5·7	5·0	7·4	6·0	2·8	4·0	5·0	6·2	4·8	6·3	4·8	4·1
194·0	207·0	175·0	199·0	182·0	171·5	185·0	195·0	186·0	193·0	192·0	187·0
36·6	42·4	36·0	45·5	47·5	42·8	44·5	59·5	50·6	35·9	49·0	44·7
14·0	18·8	14·0	14·0	16·6	12·5	14·5	12·5	12·5	16·8	12·4	14·8
63·9	65·7	57·3	60·9	67·0	57·5	63·7	65·9	63·5	58·0	67·2	63·4
55·5	53·7	40·2	57·8	61·9	53·4	54·9	57·0	65·1	59·0	57·5	56·5
42·6	36·6	36·5	37·6	33·5	33·5	41·1	37·7	33·0	36·2	38·8	39·5
28·6	24·2	24·0	26·7	27·6	27·2	29·2	29·2	28·5	24·0^{R}	28·0	27·2
35·5	32·5	30·5	33·4	28·8	29·5	34·5	33·8	28·5	31·3	32·7^{R}	32·7
77·3	80·2	66·5	80·3	77·0	65·7	72·9	75·2	73·0	76·6	75·3	72·0
64·0	62·2	55·0	62·6	63·5	56·7	59·6	63·4	66·3	52·3	59·5	63·0
110·0	116·8	117·0	110·0	95·2	91·7	100·8	109·0	96·0	103·5	97·8	104·0
58·09	56·25	48·98	55·36	70·38	62·69	63·19	60·46	66·14	56·04	68·61	60·96
89·72	83·05	77·78	92·99	107·04	97·82	94·34	99·36	104·79	88·89	102·96	87·98
117·08	124·06	138·34	119·55	112·99	132·42	120·71	134·31	130·14	117·49	123·50	139·58
53·28	55·62	47·64	58·63	52·91	57·32	50·67	54·59	51·43	63·09	60·50	55·71
44·10	49·13	36·84	37·78	46·78	47·37	45·32	49·03	67·27	36·67	36·84	45·93
91·69	102·58	101·09	93·93	85·38	96·99	92·53	93·26	94·43	97·82	92·35	109·83
86·85	81·73	70·16	94·91	92·39	92·69	86·18	86·49	102·52	101·72	85·56	89·10
42·94	52·51	47·94	38·19	44·50	38·82	42·65	35·92	40·32	42·87	37·57	39·57
66·67	55·71	63·69	61·74	50·00	58·26	63·89	57·21	51·97	62·41	57·74	62·46
125·5	129·5	141·4	122·0	113·4	119·7	122·4	125·5	112·7	122·5	114·8	124·5
69·5	70·4	75·5	64·5	74·9	67·5	72·5	70·0	64·9	71·5	82·6	66·8
64·3	69·9	73·8	66·0	67·0	71·4	66·8	71·0	73·0	68·0	68·4	73·8
74·5	65·5	64·5	73·5	81·5	79·8	85·5	79·5	84·2	77·5	71·0	78·0
102·0	88·0	103·0	100·5	99·0	99·0	113·5	104·5	105·5	107·0	103·0	100·0
103·5	85·5	101·5	102·5	99·0	99·0	115·5	105·0	105·5	109·0	103·0	100·0
88·5	85·0	88·5	89·0	91·0	90·5	93·5	93·0	95·0	93·5	98·5	90·0
27·5	22·5	39·5	27·0	17·5	19·2	28·0	25·0	21·3	29·5	32·0	22·0

R = Measurement made on Right side.

ylam Mandibles.

117	*118*	*119*	*120*	*121*	*124*	*125*	*126*	*127*
125·2	118·0	129·0	133·3	115·8	124·0	136·2	127·3	133·2
99·0	104·0	107·5	107·0	88·8	97·0	104·2	100·1	106·2
35·8	34·2	30·1	32·3	35·2	32·1	40·0	33·0	33·6
48·0	47·2	45·0	51·0	46·0	46·2	49·0	47·3	52·8
100·7	91·5	103·6	103·2	96·4	99·3	100·3	97·0	100·2
40·1	40·6	34·0	44·0	37·2	34·3	41·5	43·0	38·8
36·0	35·1	32·0	39·0	32·5	32·3	33·2	35·1	34·9
45·5	47·0	52·0	47·8	39·4	46·4	44·5	52·3	51·5
33·0	37·4	32·1	35·5	33·9	32·6	45·0	46·0	35·0
93·0	100·5	102·5	102·5	85·0	95·5	100·5	95·0	100·0
82·8	84·9	83·5	87·7	76·7	82·4	86·2	85·3	89·2
82·8	82·0	87·5	88·5	79·4	89·9	87·5	83·5	90·9
19·0	19·6	20·0	22·0	14·7	19·0	22·1	21·0	24·2
7·0	9·0	9·2	9·2	10·0	8·0	9·2	8·0	9·0
27·0	29·4	27·0 ^{R}	28·6	26·1	28·4	26·0	31·2	28·0
27·9	28·0	26·0	26·2	29·8	27·2	36·1	28·0	29·3
10·0	7·8	6·5	8·0	7·5	7·3	5·5	7·0	6·8
27·2	26·5	25·0	24·8	27·5	25·0	34·0	26·0	28·5
35·0	32·8	29·1	30·8	33·0	30·0	37·2	30·4	32·0
4·8	4·1	6·0	5·1	4·8	4·2	6·8	6·2	7·2
192·0	187·0	193·5	202·0	183·0	191·0	195·0	195·0	208·0
49·0	44·7	50·5	46·5	46·3	52·3	49·2	41·0	54·9
12·4	14·8	14·8	14·7	17·3	12·7	15·0	15·2	15·4
67·2	63·4	68·4	67·8	66·3	67·0	70·6	62·4	76·5
57·5	56·5	60·9	54·3	50·9	64·8	58·5	49·8	64·7
38·8	39·5	32·2	39·7	37·8	35·0	46·5	36·4	40·0
28·0	27·2	28·3 ^{R}	29·5	26·8	30·2	30·5 ^{R}	25·7	31·0
32·7 ^{R}	32·7	28·0	33·2	32·7	29·7	39·3	30·7	33·8
75·3	72·0	76·5	78·4	72·0	76·5	76·0	76·5	82·9
59·5	63·0	65·6	58·6	64·0	65·5	66·5	55·2	68·2
97·8	104·0	100·0	105·0	99·4	95·8	111·0	107·4	111·5
68·61	60·96	68·40	64·57	66·70	69·94	63·60	58·10	68·61
102·96	87·98	103·60	98·28	96·98	103·65	90·36	90·32	90·76
123·50	139·58	133·99	130·74	118·05	124·11	132·24	124·18	120·63
60·50	55·71	48·78	66·55	50·78	49·31	49·92	63·57	51·17
36·84	45·92	46·00	41·72	67·10	42·10	41·63	38·09	37·19
92·35	109·83	98·94	99·32	88·17	96·17	100·19	97·94	99·80
85·56	89·10	89·04	80·09	76·92	96·72	82·86	79·81	84·31
37·57	39·57	46·10	41·41	51·03	38·96	33·33	31·74	44·00
57·74	62·46	46·79	58·55	57·01	52·24	65·86	58·33	52·29
114·8	124·5	113·2	120·7	118·5	108·2	125·5	124·5	117·0
82·6	66·8	75.2	81·5	71·2	76·2	75·0	75·5	83·6
68·4	73·8	80·0	71·1	66·1	67·1	70·4	68·5	67·1
71·0	78·0	70·2	72·5	71·2	77·5	67·5	76·0	65·7
103·0	100·0	94·5	100·5	96·5	99·5	99·0	107·5	95·0
103·0	100·0	91·0	100·5	96·0	100·5	98·5	109·5	95·0
98·5	90·0	94·5	91·5	90·5	93·0	92·0	91·5	90·5
32·0	22·0	24·3	28·0	25·3	22·0	31·5	31·0	29·3

124	*125*	*126*	*127*	*129*	*130*	*132*	*133*	*135*	*136*	*137*	*138*	*139*
124·0	136·2	127·3	133·2	120·5	118·5	124·1	120·6	126·7	120·4	117·0	118·0	114·0
97·0	104·2	100·1	106·2	96·1	100·8	94·0	104·0	100·5	101·8	106·5	104·0	93·5
32·1	40·0	33·0	33·6	31·5	31·0	30·0	31·5	28·4	—	28·0	30·5	26·2
46·2	49·0	47·3	52·8	47·2	46·9	45·5	46·0	46·5	46·5	47·0	44·2	42·9
99·3	100·3	97·0	100·2	96·0	96·4	90·0	96·1	99·0	105·5	93·8	98·5	93·0
34·3	41·5	43·0	38·8	40·5	39·6	39·6	40·0	40·0	32·4	34·0	37·0	34·3
32·3	33·2	35·1	34·9	36·1	33·0	36·5	32·4	33·4	32·0	31·6	29·9	28·2
46·4	44·5	52·3	51·5	44·0	47·6	42·4	45·2	46·4	—	47·1	46·5	48·7
32·6	45·0	46·0	35·0	37·6	37·0	38·5	39·3	36·2	30·2	31·2	30·1	29·1
95·5	100·5	95·0	100·0	92·0	95·0	89·0	98·0	95·5	97·5	103·5	98·0	87·0
82·4	86·2	85·3	89·2	81·5	79·1	81·2	73·9	83·9	87·0	79·8	77·5	77·2
89·9	87·5	83·5	90·9	83·0	77·5	80·8	74·1	81·0	87·8	83·1	83·8	74·8
19·0	22·1	21·0	24·2	19·0	15·3	18·0	18·0	20·5	17·6	19·2	17·5	15·6
8·0	9·2	8·0	9·0	8·5	8·1	7·5	7·6	9·5	9·0	8·4	8·3	7·0
28·4	26·0	31·2	28·0	29·0	29·0 R	30·3	27·8	27·8	—	27·1	29·1	27·5
27·2	36·1	28·0	29·3	25·3	27·4	23·0	23·4	24·0	—	22·9	26·5	23·5
7·3	5·5	7·0	6·8	8·4	5·0	9·8	9·5	8·0	8·0	6·4	6·8	5·3
25·0	34·0	26·0	28·5	23·4	25·0	21·6	22·0	21·5	—	21·8	25·2	22·7
30·0	37·2	30·4	32·0	29·5	28·0	27·8	30·5	27·0	—	26·4	28·5	25·6
4·2	6·8	6·2	7·2	5·0	6·8	2·8	4·8	5·0	2·4	2·1	5·8	5·8
191·0	195·0	195·0	208·0	189·0	181·5	190·0	170·0	185·0	203·0	181·0	183·0	175·5
52·3	49·2	41·0	54·9	45·2	39·1	49·0	41·5	42·0	51·4	46·7	41·0	44·2
12·7	15·0	15·2	15·4	16·0	14·5	15·0	12·0	14·5	14·7	12·0	14·0	14·5
67·0	70·6	62·4	76·5	64·8	57·5	55·6	59·5	60·4	68·2	63·0	59·2	54·4
64·8	58·5	49·8	64·7	57·5	48·0	53·7	48·3	52·8	65·3	55·9	49·7	40·5
35·0	46·5	36·4	40·0	37·6	33·8	35·0	33·3	34·0	40·6	31·8	32·7	29·0
30·2	30·5 R	25·7	31·0	26·0	22·6	24·4	24·8	25·7	—	24·6	23·5	20·5
29·7	39·3	30·7	33·8	29·4	31·3	28·7	28·2	29·9	28·5 R	27·7	27·2	23·5
76·5	76·0	76·5	82·9	74·8	67·5	76·0	65·0	72·0	81·0	70·5	70·0	66·3
65·5	66·5	55·2	68·2	61·3	56·5	54·0	56·6	57·0	63·2	57·2	57·0	46·5
95·8	111·0	107·4	111·5	100·0	102·2	94·5	99·4	101·2	91·8	91·0	102·0	93·8
69·94	63·60	58·10	68·61	64·80	56·26	58·83	59·86	59·68	74·28	69·23	58·04	57·99
103·65	90·36	90·32	90·76	96·00	94·32	95·24	96·68	97·83	114·92	103·08	96·57	99·15
124·11	132·24	124·18	120·63	122·99	140·74	117·10	150·77	131·94	120·36	146·81	140·00	131·22
49·31	49·92	63·57	51·17	58·89	58·41	67·59	57·24	58·59	50·63	55·24	52·46	60·65
42·10	41·63	38·09	37·19	44·74	52·94	41·67	42·22	46·34	51·14	43·75	47·43	44·87
96·17	100·19	97·94	99·80	95·83	98·55	98·89	101·98	96·46	92·42	110·34	99·49	93·55
96·72	82·86	79·81	84·31	88·73	83·48	96·58	81·18	87·42	95·75	88·63	83·95	74·45
38·96	33·33	31·74	44·00	42·53	39·19	38·96	30·53	40·05	48·67	38·46	46·51	49·83
52·24	65·86	58·33	52·29	58·02	58·80	62·95	55·97	56·29	59·53	50·48	55·24	53·31
108·2	125·5	124·5	117·0	121·2	130·5	111·5	130·7	123·5	101·0	112·5	128·0	128·0
76·2	75·0	75·5	83·6	71·0	65·3	72·1	66·5	69·5	86·0	81·0	70·5	78·2
67·1	70·4	68·5	67·1	68·0	74·3	66·5	83·1	62·3	67·8	78·8	74·4	69·8
77·5	67·5	76·0	65·7	76·8	78·2	79·5	80·0	64·0	65·5	78·2	66·5	72·6
99·5	99·0	107·5	95·0	104·5	106·5	102·5	106·0	91·0	74·0	101·0	97·0	102·0
100·5	98·5	109·5	95·0	105·0	106·0	100·5	106·5	89·5	72·0	101·5	96·0	102·0
93·0	92·0	91·5	90·5	92·0	92·5	95·5	91·5	94·0	84·5	92·5	90·5	95·5
22·0	31·5	31·0	29·3	27·7	28·3	23·0	26·0	27·0	8·5	22·8	30·5	29·4

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I pointed out in my paper on the Hokien and Tamil the degree of orthognathism does not depend so much on lack of forward projection of the jaw as on the development of the frontal region and the consequent forward migration of the region of the nasion. For comparative purposes I have tabulated the values of both angles for the four Asiatic series. It will be seen that the profile angle bears no apparent relationship to the degree of prognathism. The total profile angle

TABLE IV.

Comparison of Profile and Total Profile Angles.

Character	Tamil	Hylam	Tibetan A	Hokien
Angle P	85°·5	85°·52	87°·4	84°·7
Angle F	89°·59	90°·79	91°·7	92°·98
100 GL/LB Gnathic Index ...	94·55	96·96	95·61	97·01

does vary approximately according to the gnathic condition. There is no doubt that the angle F is a much more valuable character than the angle P. But, on account of the fact that in most collections the bones have been collected long after death, the difficulty of pairing the mandible with the skull is almost insuperable. The more orthognathous the group the smaller is the total profile angle.

6. *Conclusions.* The most outstanding feature in the series of comparisons is the close approximation of the mean values of the various characters in the four Asiatic series. The human mandible so far as one can judge from the races compared is a much more constant structure than a superficial consideration would lead one to believe. How the modern mandible would compare with a series of prehistoric mandibles would be an interesting study. Further, the similarity of the Hokien and Hylam Chinese series is very marked in spite of the profound differences in the crania. The Tibetan A and Tamil from a study of their mandibles might almost belong to the same group. The difference between Tamil and Hokien is more pronounced, the two races belonging to different branches of the human family tree. As I have already stated in my work on the Hylam skulls, I believe the Hylam to be an impure Mongolian people with distinct affinities to the Burmese. Dr Morant in his paper on the Tibetan skull expresses the opinion that the Tibetan A people are closely allied to the southern Chinese, Malayans and Burmese. The results obtained from the study of the mandibles of these four peoples tend to confirm the observations deduced from a study of their respective crania.

I append the list of measurements of the individual mandibles for my three series. The plate shows the most typical mandible for each of the three races.

THE APPLICATION OF THE COEFFICIENT OF RACIAL LIKENESS TO TEST THE CHARACTER OF SAMPLES.

By KARL PEARSON.

It often happens that a craniological writer tends to discredit an inconvenient series of skulls by stating that the geographical district from which it is drawn contains many races. He may overlook in doing this the fact that the anthropologist who made the collection was also familiar with the fact that a mixture of races existed in the district where he was collecting. He may wholly disregard the possibility that the anthropologist or craniologist who is familiar with the skulls of many races will hardly confuse the skull of a Chinaman with that of a Hindu, or even that of a Hindu with a Burman. It becomes occasionally needful to test series which have been called into question and the problem is not an easy one, if the series be short, say, 16 to 40 crania. The obvious method is to argue that, if they are heterogeneous, their variability will probably be much above that of homogeneous series. This method will be effective if the series be long and enough characters be dealt with, but is not effective for numbers such as we have just mentioned. In such cases the standard deviation of the standard deviation, σ, may easily have values from $\cdot 2\sigma$ to $\cdot 3\sigma$, and accordingly the determination of the standard deviations of cranial characters for such *small* samples is entirely untrustworthy as a guide to homogeneity. It has occurred to me that the Coefficient of Racial Likeness can be used with far greater certainty to determine whether samples are approximately homogeneous. There are two cases which may arise: (a) We have two samples of a race, one of which is definitely known to be homogeneous, and the other has had discredit cast on it, either because the circumstances of its collection are unknown, or because, although its locus of origin is known, there exist several races or hybrids of several races in that locus, and it is asserted or suggested that the collector has not paid attention to this fact. If we form the Coefficient of Racial Likeness for the two groups, and this does not exceed the order of values we have found for it on comparing undoubtedly homogeneous samples of the same race, we may, I think, conclude that the distrust of the second sample is not justified. All, therefore, that we have to do is to fix some standard for the local differences between members of the same race, which we can use for our inquiry. We can conveniently do this on the values reached for various London series of the 17th century and for various Predynastic Egyptian series*; in all these cases we are dealing with all

* *Biometrika*, Vol. XVIII. p. 24 and Vol. XVII. pp. 16 and 19.

characters and with angles and indices separately. It will then be found that the values of the Coefficients of Racial Likeness lie below 5·0, and in the great majority of cases below 2·0. It will, I think, be justifiable to state that there is no ground for suspecting a series to differ from what it is stated to be, if its coefficients of racial likeness with an admitted sample of the same race do not exceed 3·0, and that there is no ground for very *grave* suspicion if they lie between 3·0 and 5·0.

Our second case is the following one: (*b*) Two cranial series have been given the same racial designation. Suspicion is roused with regard to both of them. Can we test whether they belong to the same population, and if so can we measure the probability that each is what it professes to be? Clearly the first part of our question can be answered precisely as in case (*a*). But if they satisfy case (*a*) and are drawn from a locality containing more than one race, then it is extremely unlikely that both samples would have been drawn in the *same* proportions, and so their coefficients be below the accepted standard value. But we can often proceed further and test our samples bearing the same label with a homogeneous population of the race which is supposed to form one of their constituents. If the coefficients are now of a higher order, we have additional evidence of our series having small relationship to the supposed diluting population.

These matters will be rendered more clear by an illustrative example. But before giving this let me make a remark. The origin of a particular series of crania may be obscure owing to carelessness on the part of the collector, or it may be obscure because for many reasons it is not desirable to make it known. Anyone who has formed a large cranial collection will be well aware of instances where it has been undesirable to refer in detail to the exact locality, or the exact group from which they were procured; to do so might be to wound religious scruples, or actually injure a man who has obtained them for scientific and not for commercial purposes. This is especially the case when we seek for Hindu or Chinese crania; even in our own country the man who tries to study on the skull the development of his own race runs the risk of being looked on as little better than a body-snatcher. It seems to me that for many years to come series of oriental crania must be vaguely described. Our illustration shall be taken from Professor Harrower's paper in this issue.

He tells us that the so-called Hindu, Chinese and Malay material provided in earlier issues of this Journal is useless for scientific comparison. "The origin and source of the skulls are much too obscure to be of any real value in my opinion*." Now the Malay material for males was *exclusively* that of Dr Emil Schmidt, in Leipzig, who purchased the v. d. Hoeven collection. The great majority of the crania are labelled: *Cranium malaici ex Java insula.* They were accepted by Dr Emil Schmidt—a great craniologist—as genuine Malay crania. There exists another long series of Malay skulls; until this has been measured and its coefficient with the Schmidt series determined, it would be idle to discuss whether Schmidt's series is or is not what it professes to be.

* See p. 248 above.

We now turn to the Chinese series, which Professor Harrower rejects. The constants of three such series have been determined* and can be compared with those of the crania of Professor Harrower's Chinese coolies from Hokien, which he considers form a homogeneous group.

Hokien Chinese and (Harrower, 36·0)	Southern Chinese (Various Collections, 52·3)	Northern Chinese (Various Collections, 36·4)	Northern Chinese (Koganei, 69·4)
Coefficient. All Characters	1·76 ± ·18 (27)	1·62 ± ·17 (31)	1·54 ± ·21 (19)
,, Angles and Indices	1·24 ± ·29 (10)	2·10 ± ·26 (12)	0·35 ± ·41 (4 !)

These coefficients are all less than our standard value, and it would be impossible on the basis of them to assert any racial difference between Professor Harrower's Hokien and the series he rejects as "useless for scientific comparison." If these Chinese series, measured before Professor Harrower's Hokien, are really heterogeneous in character, then we must suppose in order to produce such small coefficients that the Hokien crania are mixed in like proportions. I think, on the other hand, that we have to thank Professor Harrower for confirming the view that the great majority of the Chinese skulls in European collections are what they profess to represent, neither Malays nor Burmese nor even Chinese hybrids, but genuine racial Chinese.

We now turn to the Hindus. Of these we have three series upon which discredit has been cast, as the name is said to mark only a religious group, and accordingly may cover persons of Dravidian origin. We shall obtain the best results here if we compare the Hindu series with each other, the Dravidian series with each other, and then the Hindus with the Dravidians. We have the following four series of skulls labelled Hindu:

Hindus:

(*a*) A series of some 40 to 60 male skulls, which are said to come from North East India, principally from Bengal†.

(*b*) A series of 42 male skulls of Bengalee Hindus measured by Danielli. (*Archivio per l'Antrop. e Etnol.* Firenze, Vol. XXII. pp. 371—448.)

(*c*)‡ A series of 24 male skulls of Hindus from Southern India measured by Mantegazza. He did not give further details of their origin, but divided them into high and low castes, and stated that he did not consider this affected sensibly the type. (*Ibid.* Vol. XIII. pp. 177—241.)

(*d*) A series of 25 male skulls from North East India labelled Uriya, which is the mother-tongue of the Hindus of Orissa. They are in the India Museum. Turner

* Morant: *Biometrika*, Vol. XVIII. p. 416.

† Ten of these were presented to me by a high caste Hindu, and I know the locus of their origin.

‡ Stoessiger has unfortunately interchanged her (*b*) and (*c*) on pp. 126 and 129 of *Biometrika*, Vol. XIX.

divided these skulls into three groups by means of broad cephalic index categories. His procedure appears to be quite unjustified, but has succeeded in casting discredit on the series as a homogeneous group.

Dravidians:

We have three series which may be supposed to be Dravidian rather than Aryan.

(*e*) A series of 40 (37 male) skulls said to have belonged to members of the Maravar tribe in the Madras Presidency, and were supposed to be of Dravidian stock.

(*f'*) A series of 15 male skulls chiefly in the India Museum, and asserted to be Dravidians from the Central Provinces and Orissa with one Tamil from Madras.

(*f''*) A series of 18 male skulls in the India Museum chiefly belonging to the Munda and Kol tribes. Sir William Turner considered the distinction between (*f'*) and (*f''*) to be linguistic rather than physical.

Miss B. N. Stoessiger* has determined the Coefficient of Racial Likeness between (*f'*) and (*f''*). She found

Coefficient for All Characters	$\cdot 03 \pm \cdot 20$ (23).
„ „ Angles and Indices	$\cdot 54 \pm \cdot 36$ (7).

It is safe to say that no distinction can be made between (*f'*) and (*f''*) and we can pool them as our second reputed (*f*) series of Dravidians.

(*g*) A series of 35 male skulls of coolies from Southern India who died in Singapore, and are termed by Professor Harrower Tamils. The Tamils of India number some 15,000,000, but whether this vast population speaking a common language can be considered in a group of 35 coolies any more homogeneous when labelled as coming from Southern India, than a group of 42 Bengalee labelled Hindus, seems unproven.

(*h*) A series of 13 male Tamil skulls from Ceylon collected by the Brothers Sarasin (*Ergebnisse naturwissenschaftlichen Forschungen auf Ceylon*, 1892–4).

At any rate it seems worth while examining what light can be thrown on these groups (*a*), (*b*), (*c*), (*d*), (*e*), (*f*), (*g*) by means of the Coefficient of Racial Likeness. The values of the characters have been determined by Tildesley, Morant and Stoessiger, and to the last two I owe the coefficients cited in the following tables.

I reproduce first from Stoessiger her table of the four Hindu series and the Maravar.

In the first place it will be observed that the Hindu series (*a*), (*b*), (*c*) and (*d*) are in striking accordance one with the other. They are in closer agreement with each other than English crania from London graveyards of the same period; they agree as well as, if not better than, series of Predynastic Egyptian crania. It is impossible to assert of the Hindu series (*a*), (*b*), (*c*) and (*d*) that they are not samples drawn from the same group. If that group be racially heterogeneous, then our four samples have practically been mixed in much the same proportions. Such a mixing

* *Biometrika*, Vol. XIX. p. 127.

TABLE I.

Table of Hindu Series and Maravar.

		Hindu (*a*) (29·2)	Hindu (*b*) (40·1)	Hindu (*c*) (23·0)	Hindu (*d*) (24·8)	Maravar (28·5)
Hindu (*a*) (29·2)	All Characters	—	1·95 ± ·21	− ·09 ± ·25	·13 ± ·21	1·80 ± ·20
	Angles and Indices	—	2·74 ± ·43	− ·50 ± ·48	− ·31 ± ·39	2·03 ± ·36
Hindu (*b*) (40·1)	All Characters	1·95 ± ·21	—	·45 ± ·23	1·74 ± ·21	1·46 ± ·21
	Angles and Indices	2·74 ± ·43	—	·72 ± ·43	·75 ± ·43	1·48 ± ·36
Hindu (*c*) (23·0)	All Characters	− ·09 ± ·25	·45 ± ·23	—	− ·63 ± ·23	·01 ± ·23
	Angles and Indices	− ·50 ± ·48	·72 ± ·43	—	− ·20 ± ·43	− ·60 ± ·38
Hindu (*d*) (24·8)	All Characters	·13 ± ·21	1·74 ± ·21	− ·63 ± ·23	—	·19 ± ·23
	Angles and Indices	− ·31 ± ·39	·75 ± ·43	− ·20 ± ·43	—	− ·49 ± ·38
Maravar (28·5)	All Characters	1·80 ± ·20	1·46 ± ·21	·01 ± ·23	·19 ± ·23	—
	Angles and Indices	2·03 ± ·36	1·48 ± ·36	− ·60 ± ·38	− ·49 ± ·38	—

seems very improbable, but granting for a moment that it exists, we can compare the results with those of a tribe—the Maravar—asserted over and over again to be "Dravidian." We find that our material will not allow us to assert any racial difference between the Hindu series (*c*) and (*d*) and the Maravar; the relation between the Maravar and Hindu series (*a*) and (*b*) is very close, just in fact what we might expect between two local branches of the same race; it is indeed closer than we find between English skulls of the same period drawn from such adjacent burial sites as Whitechapel, Moorgate and Farringdon Street*, and less than the divergence between the Hindu series (*a*) and (*b*). We are thus reduced to the conclusion that these so-called "Dravidian" Maravar are really identical with Aryan Hindus or else that the four Hindu series agree so well among themselves because they are predominately Dravidian and of practically the same Dravidian intensity as the Maravar†.

* *Biometrika*, Vol. XVIII. p. 24.

† There is the possibility, it may be very slight, that the skulls sent by Dr Shortt as Maravar may really be those of Hindus who had penetrated into the Madura district. It is extraordinary that the skulls of a rather lawless tribe near Cape Cormorin should agree so closely with those of Bengalee Hindus, and more closely with the Dravidians of Orissa and the Central Provinces than with the Tamils of Ceylon or Southern India. My suspicions as to the so-called "Maravars" are partially confirmed by an examination of Dr Shortt's letters to the Curator of the Museum of the Royal College of Surgeons, and by the information which Miss Tildesley gives me as to the state of the skulls themselves. Dr Shortt's letter of March 22, 1878, reads: "I write to inform you, that I have sent through Messrs Shaw and Wynch of Madras one case containing 20 skulls and 2 [specimens] of mycetoma, which I trust will reach you safe. The skulls are chiefly from the Madura district and belong to the tribe known as Maravars." No other letter seems to refer to these crania. Dr Shortt says nothing of where or how the skulls were obtained and even suggests that they may not all be Maravars. Miss Tildesley says she has examined the series for internal evidence. "They have been pretty well cleaned, and about some I could not say for certain that they were not hospital specimens. But as I found tiny roots still adhering to the interstices of five or six and the remains of sandy soil in another; further, as a number

Now let us look at the series (*e*), (*f*), (*g*) and (*h*) as representatives of Dravidian races.

TABLE II.

Table of supposed Dravidian Series.

	Maravar (*e*) (28·5)	Dravidians (Turner) (*f*) (31·3)	Tamils from Ceylon (Sarasin) (*h*) (12·6)	Tamils from Southern India (Harrower) (*g*) (35·0)
Maravar (*e*) (28·5)	—	3·13 ± ·23 (16) 2·51 ± ·38 (5)	4·53 ± ·24 (15) 4·23 ± ·38 (5)	5·82 ± ·23 (16) 2·24 ± ·67 (3!)
Dravidians (*f*) (Turner) (31·3)	3·13 ± ·23 (16) 2·51 ± ·38 (5)	—	1·57 ± ·21 (20) 0·87 ± ·33 (7)	6·67 ± ·20 (23) 4·95 ± ·36 (7)
Tamils (*h*) (Sarasin) (12·6)	4·53 ± ·24 (15) 4·23 ± ·38 (5)	1·57 ± ·21 (20) 0·87 ± ·33 (7)	—	2·25 ± ·19 (21) 3·54 ± ·32 (8)
Tamils (*g*) (Harrower) (35·0)	5·82 ± ·23 (16) 2·24 ± ·67 (3!)	6·67 ± ·20 (23) 4·95 ± ·36 (7)	2·25 ± ·19 (21) 3·54 ± ·32 (8)	— —

The first numbers in each cell refer to all characters, and the second to angles and indices only.

It will be at once clear from this table that the four series ascribed to Dravidian sources are far less alike among themselves than the four series ascribed to Hindus. The only two series which show close resemblance are the Dravidians (Kolarians and Dravidians of Turner) and the Tamils of Ceylon due to Sarasin. The Maravar are in all three cases considerably farther removed from these supposed Dravidian groups than they are from any of our four Hindu series. We believe, therefore, that whatever the cultural, linguistic or flesh differences may be, it is not possible craniometrically to distinguish the Maravar from the Hindu series, but it is possible to distinguish them craniometrically from Kolarians and Tamils. While Harrower's Tamils differ considerably from Turner's Dravidians, the latter as we have seen are closely linked to Sarasin's Ceylon Tamils and these again are closer than any other group we have yet found to Harrower's coolies. We shall, therefore, in comparing Hindus and supposed Dravidians confine our attention to series (*f*), (*g*) and (*h*) and compare them with (*a*), (*b*), (*c*) and (*d*). The Coefficients of Racial Likeness are given in Table III.

of them are much marked on the surface with the little lace work pattern which I presume is eaten into the outer table by the action of roots (and even if it were not, it is not what we get in macerated specimens that go straight to Museums!), there is evidence that a number of them were buried. I think it probable that the whole series would be obtained in the same way, the more recently buried being lighter in colour and with outer table undamaged." As the matter stands we have therefore a series of skulls probably found buried in the Madura district, but no definite evidence to say that they were certainly Maravars. The bulk of them may have been the skulls of Hindu soldiers killed in some fight.

TABLE III.

Table of Coefficients of Hindu and Dravidian Series.*

	Hindu (*a*) (29·2)	Hindu (*b*) (40·1)	Hindu (*c*) (23·0)	Hindu (*d*) (24·8)
Dravidians (Turner) (31·3)	4·53 ± ·20 (21) 8·92 ± ·33 (7)	7·96 ± ·21 (20) 13·16 ± ·38 (5)	4·07 ± ·22 (17) 7·56 ± ·38 (5)	3·16 ± ·19 (23) 5·24 ± ·33 (7)
Tamils of Ceylon (Sarasin) (12·6)	4·89 ± ·21 (19) 6·41 ± ·33 (7)	5·92 ± ·22 (18) 7·72 ± ·38 (5)	4·33 ± ·23 (16) 7·04 ± ·38 (5)	2·36 ± ·21 (20) 3·77 ± ·33 (7)
Tamils of Southern India (Harrower) (35·0)	3·79 ± ·17 (30) 3·36 ± ·26 (12)	9·52 ± ·20 (22) 12·38 ± ·36 (6)	3·58 ± ·22 (17) 3·40 ± ·38 (5)	4·73 ± ·20 (22) 3·60 ± ·33 (7)
Maravar (28·5)	1·80 ± ·20 (22) 2·03 ± ·36 (6)	1·46 ± ·21 (20) 1·48 ± ·36 (6)	0·01 ± ·23 (16) −0·60 ± ·38 (5)	·19 ± ·23 (16) −·49 ± ·38 (5)

While none of these values indicates such a wide divergence as may be found between Bavarians and Würtembergers (12·1 ± ·19) or between 17th century Londoners and Modern French (24·5 ± ·18)†—indicating that Hindus and Dravidians are not really so different as various European races—yet they show that the Hindu series are in all cases, except one, significantly different from the Dravidian series. The exception is the Maravar series of which we have already spoken; it is close to the Hindu series and diverges from all the Dravidian series.

The conclusions to be drawn from our three tables are the following:

(i) The four Hindu series are in striking accordance with one another.

(ii) They disagree with all the Dravidian series (except the Maravar, which is very possibly wrongly named).

(iii) The Dravidian series do not agree well among themselves and probably do not represent any single homogeneous race.

These conclusions would be explicable if we consider our Hindu series to be practically homogeneous, but our Dravidian series to be heterogeneous, mixed probably with different degrees of Aryan Hindu blood.

It does not seem, therefore, that we can agree with Professor Harrower in his condemnation of the Hindu series as "useless for scientific comparison," and we believe that he has formed too high an estimate of the homogeneity of his own Tamil sample from "Southern India."

* Six of these coefficients are due to Stoessiger, ten to Morant.

† *Biometrika*, Vol. XIII. p. 249.

A PRELIMINARY CLASSIFICATION OF EUROPEAN RACES BASED ON CRANIAL MEASUREMENTS.

By G. M. MORANT, D.Sc.

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"Cependant il sera bien difficile de marcher d'un pas sûr, avant d'avoir réuni plus de lumières et d'avoir plus d'observations exactes que nous n'en possédons maintenant. C'est de la bonté des matériaux que doit dépendre la solidité de l'édifice." QUÉTELET, *Physique Sociale, ou Essai sur le Développement des Facultés de l'Homme*, 1869.

(1) *Introduction.* The classification of existing European races which is most generally accepted to-day is that of Ripley*. He distinguished three "racial types" which were called the "Teutonic" (more usually called the "Nordic" by those who follow his scheme), the "Alpine" and the "Mediterranean." The characters used to differentiate the types were principally the cephalic index of the living head, stature and hair and eye colours; but some use was also made of the length and breadth of the face and the breadth of the nose. Hardly any actual measurements are quoted by Ripley, but in a number of maps he shows the distributions of average characters for Europe as a whole and for various countries. Many of the areas shaded to represent different ranges of the variate were filled in either on the basis of the most meagre evidence, or else by inference alone. As the means shown in that way are only given within wide limits, and without any indication of the number of observations on which they are based, they are nearly worthless for statistical purposes. He made no attempt to determine the limits of the characters which might define the "racial types," so the distinction between them is not precise. The characters used were apparently only chosen because more data were available for them than

* William Z. Ripley: *The Races of Europe.* London (1900).

for any others. It is said that "the colour of the hair and eyes, and stature especially, are open to modification by local circumstances; so that racial peculiarities are often obscured or entirely reversed by them. On the other hand, the general proportions of the head seem to be uninfluenced either by climate, by food supply or economic status, or by habits of life; so that they stand as the clearest exponents which we possess of the permanent hereditary differences within the human species*." It would seem that stature and hair and eye colours were among the worst possible characters that could have been selected by anyone holding such views, as he is obliged to make a continual, and necessarily inexact, allowance for the varying environmental conditions. The lack of any established inter-racial correlation between the qualities used made the handling of several of them together a matter of great complexity, and, actually, neither Ripley nor his successors have made any attempt to analyse the material by rigorous quantitative methods. By summarising a vast amount of material they have undoubtedly performed a useful service, but it is by no means clear that the data were capable of yielding the results which were said to be deduced from them. Ripley's classification of European races was suggested largely by the analyses of earlier workers, and he acknowledges his indebtedness to them. Using the same three characters, Deniker had distinguished six principal and four secondary races†. Ripley accounts for the discordance between his own scheme and that of Deniker by supposing that the latter had neglected "to eliminate all the modifying influences of environment, physical or social; of selection in its various phases; and of those other disturbing factors, which, together with the direct and perhaps predominant influences of heredity, constitute the figure of man as he stands‡." The accuracy of the results obtained will hence depend on the exactness with which it is possible to make allowance for these diverse factors, and as the allowance will be largely a matter of personal opinion we must necessarily abandon all hope of being able to arrive at any quantitative expression of the ultimate hereditary relationships by using such methods.

The anthropologist is being continually confronted with the fact that no two characters will suggest precisely the same arrangement of the racial types, and there is often no sufficient reason why the evidence of one character should be given more weight than that of another. He is, in reality, groping in the dark owing to the absence of that guiding light which would be furnished by a complete knowledge of the intra- and inter-racial correlations of physical qualities. If his object is to classify a group of races, then it will clearly be most advantageous to select characters which are not affected by environment; and those who believe that the stature and integumentary colours are so affected should find others to replace them. The cephalic index remains, but all would agree that, by itself, it is not capable of leading to a reliable classification. The linear arrangement which it can alone suggest is obviously too simple to correspond to the actual complicated web

* *Op. cit.* p. 52.

† This early classification of Deniker's was still adhered to in the last (posthumous) edition of: *Les Races et les Peuples de la Terre.* Paris, 1926 (see p. 407 *seq.*).

‡ *Op. cit.* p. 600.

of relationships. A two-dimensional arrangement furnished by any two characters will still suffer from the same defect, and it is extremely probable that no three will ever be found capable of revealing the true state of affairs. It is a curious fact that those who have insisted on the complexity of the inter-relations of European races should ever have hoped to unravel them with the aid of so few characters. Statistical analysis demands the collection of a large number of observations, but to aid the solution of these problems it is more important that they should relate to a considerable number of characters than that attention should be concentrated on two or three. While we are obliged to remain in ignorance of the inter-racial correlations, owing to lack of sufficient material, the only safe method of procedure is to utilise as many different characters as possible, provided that their inter-racial correlations are not too high. At the present moment, skull measurements are more capable of fulfilling all the required conditions than any other anthropological data. Measurements of other bones of the skeleton, and of the living body, have, as yet, been provided for too few races and their value—as, indeed, for the skull as well—is very considerably diminished by the fact that different, and often incomparable, methods of technique have been used to determine them. Head measurements are even more unsatisfactory owing to that same condition, and most of the few characters usually recorded are highly correlated with one another. The skeleton has an immense advantage over the living body in that it is available for extinct as well as for existing populations. It is by tracing their ancestry backwards that we are most likely to arrive at a sure knowledge of the inter-relations of modern races.

An attempt is made in the present paper to establish a preliminary classification of European races based on a small sample of cranial series dating from Neolithic to modern times. The comparisons between the types are made, where possible, for a group of 31 characters representing all the more important regions of the skull. It is generally believed that these characters are not influenced to any marked extent, if at all, by environmental conditions. The method of Professor Karl Pearson's coefficient of racial likeness has greatly facilitated the work, as it enables us to express at once by a single number the relative degree of divergence of all the characters which are available for the two series compared. Without the aid of that method it would have been far more difficult, if possible at all, to arrive at any definite and self-evident conclusions. From a statistical point of view the great weakness of this study will be seen to be due to the paucity of the material used. Nearly all the means representing the types are based on statistically small series, though that deficiency is partly compensated for by using a considerable number of characters having few high correlations one with another. And the number of types represented must be supposed small compared with the total number that have existed from Neolithic to modern times. Owing to these limitations, the classification suggested is essentially an interim one only, but, as it has been arrived at by using purely quantitative methods, so we may hope that it will be possible to consolidate and extend it by considering the evidence of additional material.

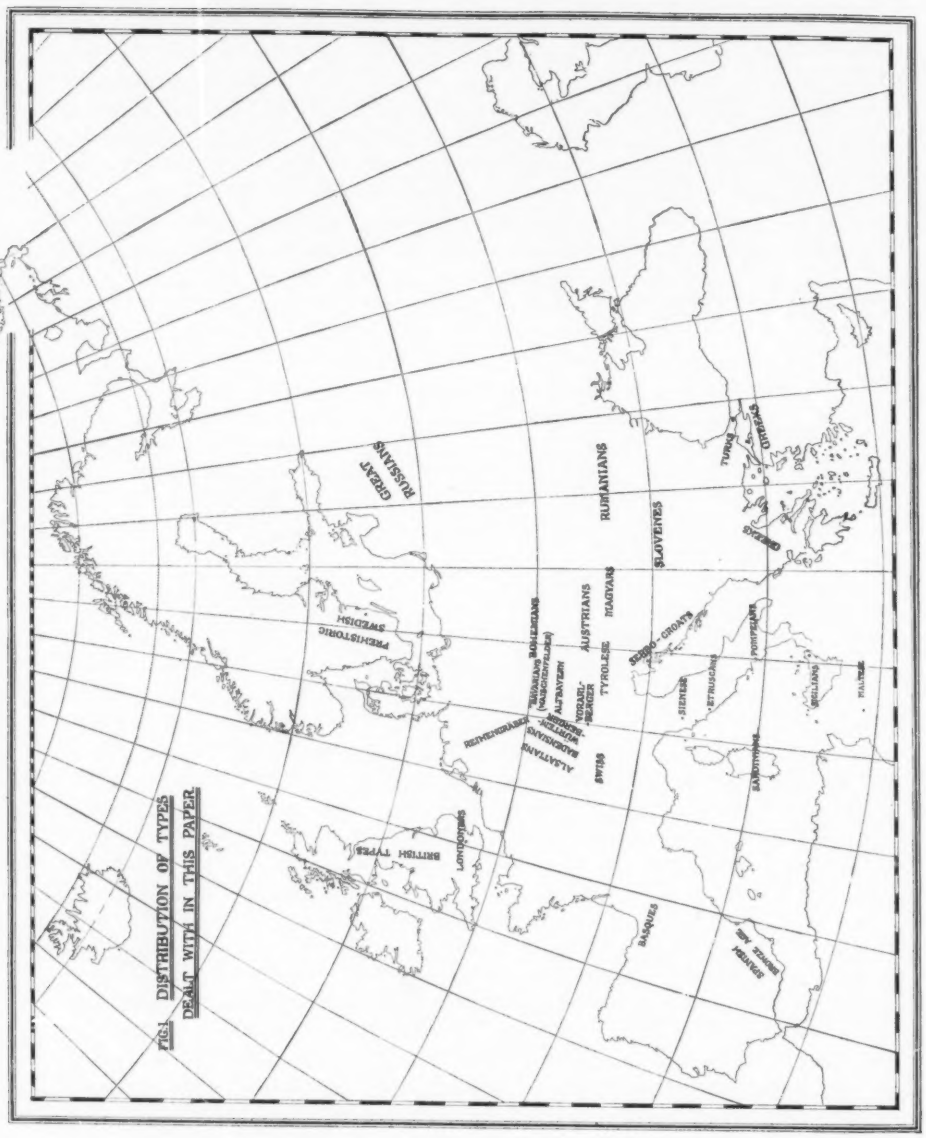


FIG. 1. DISTRIBUTION OF TYPES DEALT WITH IN THIS PAPER
GREAT RUSSIANS
RUMANIANS
SLOVENES
MAGYARS
AUSTRIANS
TYROLESE
BOHEMIANS
SERBO-CROATS
ALSATIANS
SWISS
PRE-HISTORIC SWEDISH
BRITISH TYPES
LONGBARDS
BASQUES
SARDINIANS
SICILIANS
MALTESE
ETRUSCANS
TURKS
GREEKS

(2) *The Material.* The material dealt with in this paper consists of 41 ♂ cranial series. Thirty-one of the series are of modern or mediaeval date, and more than half of that number certainly represent populations which existed later than A.D. 1600. It is probable that almost all these types are persisting to-day. A series from Pompeii belongs to the Roman period. The Guanche skulls are of doubtful date, though certainly anterior to the Spanish occupation of the Canary Islands at the end of the 15th century. The British Iron Age series represents chiefly the the Romano-British period and the Etruscans belong to the Etruscan and Roman periods. There are two Bronze Age series; one from England and the other from the south-east of Spain. Egypt is represented by a series of 26th—30th Dynasty skulls from Gizeh and another of Late Predynastic date from Naqada in Upper Egypt. The Swedish Prehistoric series covers the Neolithic, Bronze and Iron Ages and there is one purely Neolithic series from England and Scotland. The later periods are far more adequately represented than the earlier ones. The ethnic constitution of Europe has changed fundamentally between the Neolithic Age and the present day, and it is obvious that we cannot hope to gain, from this material, any true conception of the racial distribution at any particular time. Four of the series came from localities outside Europe; three from Egypt and one from Teneriffe, while half of the Greek skulls were collected in Asia Minor. The geographical distribution of the European material is shown in the accompanying map, Fig. 1. Central and South-Eastern Europe are fairly well represented in mediaeval and modern times, but there are large areas for which no skulls of any date have been considered. The material is only part of the total available for European races, and it was selected merely because it was the most suitable to which the writer had ready access. The numbers of skulls in the several series range from 29 to 935, but the majority contain from 50 to 100 individuals. The characters considered are a standard set of 31 used in computing the coefficients of racial likeness and a few additional ones; several others for which some data are available have been neglected. In the case of the majority of the series, means can be given for more than half of the selected characters, and there are only three with fewer than 15 of the 31 which are ideally required. But the value of the material is very considerably reduced by the fact that different workers have measured the same character in slightly different ways. The greatest care was taken to ensure that comparison was only made between measurements which were said to have been determined by using identical technique, and several doubtful and insufficiently defined measurements had to be rejected on that account. In a few cases a comparison of the means suggested that some of the measurements are extremely unlikely to have been found in precisely the same way, although identical definitions were said to have been used*. Such cases were rare, however, and there is only one coefficient (viz. that between the Würtemberger and Badensians in Table I) which is markedly affected by a comparison which is probably erroneous. Without some decisive evidence to show which one of two means was the correct one, it seemed safer to retain both of them. Details regarding the origin of the series, and

* See especially the comparison of palatal measurements in Section (6) below.

other notes, are given together with the references in Appendix I. The measurements used are defined in Appendix II, and the means, of which the greater number were reduced by the present writer, are in Appendix III. A great assumption is made, of course, in labelling a type determined from 50 or 100 skulls with the ethnic title which may apply in reality to a population of several millions living at one particular time. The legitimacy of such an assumption can only be tested by making comparisons with other samples drawn from what is presumed to be the same population. The urgent need is for the extension of the material so as to include racial types which are not represented at all by these series.

(3) *The Use of the Coefficient of Racial Likeness.* The coefficient of racial likeness was devised by Professor Karl Pearson, and his paper on it was published after the method had been fairly extensively used by workers in the Biometric Laboratory*. The object of the coefficient is to provide a single numerical measure of the differences between a number of characters provided for two racial groups. If m_s, σ_s and n_s are the mean, standard deviation and number of individuals respectively for the sth character of the first group, and m_s', σ_s' and n_s' are the corresponding constants for the sth character of the second group, then:

$$\text{C.R.L.} = S\left\{\frac{1}{M}\left(\frac{(m_s - m_s')^2}{\frac{\sigma_s^2}{n_s} + \frac{\sigma_s'^2}{n_s'}}\right)\right\} - 1 + \frac{1}{M} \pm \cdot 67449\sqrt{\frac{2}{M}\left(1 - \frac{1}{M}\right)},$$

where there are M characters compared. If the two samples were actually drawn from the same population, then the coefficient will vary round zero with a probable error of $\cdot 67449\sqrt{\frac{2}{M}\left(1 - \frac{1}{M}\right)}$. That complete form of the formula has to be adapted for practical use. If the number of skulls in the series be small—less than 100, say—then the standard deviations of the characters cannot be found with sufficient approach to the true values, and, in that case, it may be assumed that the σ's are equal to those of the longest series available which belongs to the same family of races. If that assumption be made for both series, then $\sigma_s = \sigma_s'$ and

$$\text{C.R.L.} = S\left(\frac{1}{M}\frac{n_s n_s'}{n_s + n_s'} \times \frac{(m_s - m_s')^2}{\sigma_s^2}\right) - 1 + \frac{1}{M} \pm \cdot 67449\sqrt{\frac{2}{M}\left(1 - \frac{1}{M}\right)}.$$

The present inquiry deals with series of European type and, for such, standard deviations have been given of two English and two Egyptian series. One of the former was chosen as it may be supposed nearer to the average European type than the Egyptians are. The standard deviations provided by Miss B. G. E. Hooke for a series of 17th century London skulls from the cemetery in Farringdon St.† have been used throughout. Comparisons are only made between male series. The substitution of a constant set of σ's for the true and unknown values, which would

* "On the Coefficient of Racial Likeness," *Biometrika*, Vol. XVIII. 1926, pp. 105—117.

† B. G. E. Hooke: "A Third Study of the English Skull with special reference to the Farringdon St. Crania," *Biometrika*, Vol. XVIII. 1926, pp. 1—55.

certainly vary slightly from series to series, must necessarily introduce an element of some uncertainty into the calculations. But this disturbing factor may be considered of small account. The 31 characters used are precisely the same as those of previous investigations *. They were chosen with the object of representing all the more important regions of the calvaria and facial skeleton, and they include absolute, indicial and angular measurements. The theoretical condition that all the characters should be uncorrelated with one another intra-racially is not fulfilled, but it is known that most of the correlations are not high. Another consideration is of greater importance. The technique of craniometry is not yet standardised, and, in practice, we are confronted with series of measurements determined by different methods, so that direct comparison cannot be made between all the characters. Furthermore there are few of the 41 series for which all the selected measurements have been provided and, owing to these facts, it frequently happens that the coefficient has to be based on far fewer than the complement of 31 characters. For the 820 coefficients the mean number of characters used is 18·42, and there are some given for as few as 6. Dealing with the earlier material, Professor Pearson found a correlation coefficient between the size of the coefficient and the number of characters used of ·053 ± ·038 with a population of 313 †. For our 820 coefficients the same $r = -·189 \pm ·023$, so there is a small but distinct suggestion that those based on the smaller numbers of characters tend to have higher values. A reasonable explanation of that fact can be given. It is found (see Table XVI below) that the average contributions of the various characters are far from being constant. In general, a certain group of calvarial measurements shows differences which are appreciably more significant than any others. When comparisons are restricted to a few characters, those few are not selected randomly from the total 31, since the influential calvarial measurements are invariably retained. Hence a negative correlation is to be expected between the size of the coefficient and the number of characters. The fact that one was not found by Professor Pearson may be attributed to the different constitution of the population with which he was dealing. The earlier one was heterogeneous, in so far as it included comparisons between members of several different families of races, and, in general, the only comparisons made had been ones likely to give low coefficients; the present material is, in a wide sense, confined to a single family of races, and comparisons have been made between every possible pair of series. The number of characters must be recognised as a factor which does influence the coefficient, though to a lesser extent than some other factors. No account has been taken of it in the following sections of this paper. It may be assumed that the coefficients based on the smaller numbers of characters will, at any rate, be close approximations to those which would be given if all 31 characters were available.

A consideration of far greater importance concerns the influence which the number of individual crania in the series has on the coefficient. All the means given for a particular series are not usually based on the same number of skulls

* A list of the characters is given, with definitions, in Appendix II below.

† *loc. cit.* p. 116.

owing to the inclusion of imperfect specimens. The mean number of skulls available for the characters used in computing the coefficients is $\bar{n}$, say. Then the $\bar{n}$'s for the 41 series range from 24·2 to 857·0, though there are only 7 greater than 100. Professor Pearson correlated the $\bar{n}$ with the size of the coefficient, entering each coefficient twice as each race in the comparison has an $\bar{n}$. For 580 entries (or 290 coefficients) he found $r = +\cdot127 \pm \cdot028$ *. For the present material the same table has 1640 entries (based on 820 coefficients) and $r = +\cdot252 \pm \cdot016$. The second correlation coefficient is significantly greater than the first, and that must again be supposed due to the fact that the populations were made up in different ways. But this is hardly the best way of estimating the influence that the sizes of the two series together exert on the coefficient. The correlation really required is that between the size of the coefficient and $\bar{n}_1 \bar{n}_2/(\bar{n}_1 + \bar{n}_2)$, where the suffixes 1 and 2 denote the first and second series in a particular comparison. If $\bar{n}_2 > \bar{n}_1$ that expression has the limiting value $\bar{n}_1$, and it will not be greatly affected by large changes in $\bar{n}_2$ if $\bar{n}_1$ remains constant. If the sizes of the samples really exert an appreciable influence on the coefficients, then it may be anticipated that the correlation between the smaller of the two $\bar{n}$'s and the value of the coefficient will be greater than the correlations recorded above. A table prepared in that way for the 820 coefficients gives a coefficient $r = +\cdot505 \pm \cdot022$. The question may be also examined in a rather different way. Below are given the mean coefficients when both $\bar{n}_1$ and $\bar{n}_2$ lie within certain restricted ranges.

Range of $\bar{n}_1$ and $\bar{n}_2$	No. of C.R.L.'s	Mean C.R.L.
24— 29	6	6·6
30— 42	28	16·8
49— 67	45	23·2
76— 96	55	22·9
99—857	28	79·3

There is a marked rise in the size of the coefficient as both $\bar{n}_1$ and $\bar{n}_2$ increase in size and the discordantly high mean for the range from 49—67 is evidently due to the fact that two series (the Predynastic Egyptians and Sardinians) which are included in that group are as widely removed as any from the generalised European type. From this experience, it is obvious that it would be quite illegitimate to compare the coefficients directly without making some allowance for the varying sizes of the samples dealt with. We are reminded of the fact that the coefficient is a measure "not of how far the two races or tribes are alike or divergent, but of *how far on the given data* we can assert significant resemblance or divergence †." But the anthropologist is not interested in measures of probability on their own account. He has need rather of a measure of the absolute racial divergences. Professor Pearson has pointed out that the coefficient of racial likeness could be used as such if the samples were all of a constant and adequate size, say 50 or 100

* *loc. cit.* p. 116.

† *loc. cit.* p. 105.

crania. The sampling errors would then be neglected as they would be small compared with the inter-racial differences. It is suggested that the following methods of comparison may be used until such material is available. If all the $\bar{n}_1$'s and $\bar{n}_2$'s are within a restricted range which is fixed arbitrarily, then the effect of their variation may be neglected and the resulting coefficients can be compared directly. Or direct comparison may be made within another group of coefficients if all the $\bar{n}_1$'s are within a certain restricted range and all the $\bar{n}_2$'s within another restricted range, both ranges being fixed arbitrarily. A considerable number of direct comparisons may be made by adopting these conventions, but another is needed to determine whether any pair of coefficients be of the same order or not. The method used has been to calculate the coefficients in full, in the usual way, and then to adjust one to a value it may be presumed to have if its $\bar{n}$'s were the same as for the other. Or if $\bar{n}_1$ and $\bar{n}_2$ are the sizes of the two samples which lead to the first coefficient, and $\bar{n}_3$ and $\bar{n}_4$ are the sizes of the two samples which lead to the second coefficient, then the first multiplied by $\frac{\bar{n}_3\,\bar{n}_4}{\bar{n}_3+\bar{n}_4} \times \frac{\bar{n}_1+\bar{n}_2}{\bar{n}_1\,\bar{n}_2}$ may be compared directly with the second. This is not the same thing as omitting the n's in calculating the coefficients and then comparing them directly, since the n's are usually not constant for the different characters given for a particular series. The varying significances of the differences are weighted as they clearly ought to be.

(4) *Coefficients of Racial Likeness between European Series.* The coefficients of racial likeness were calculated for every pair of the 41 series dealt with in the present paper, so there is a total of 820. From the foregoing investigation of the effect which the number of skulls in the series has on the coefficient, it is evident that it would be invalid to compare them without making allowance for that variable factor. The procedure which may be adopted in practice has already been described (Section (3)). The largest group of series for which the mean n's ($\bar{n}$'s) are nearly equal and of an adequate size is that dealt with in Table I, and the $\bar{n}$'s range from 76 to 96. It will be safe to compare the resulting coefficients one with another directly. They are all based on an adequate number of characters except those with the Alsatians, and it has been shown that such inadequately defined ones are slightly greater on the average than they would be if more characters were available. The coefficient between the Badensians and Würtemberger is enormously affected by the palatal length, breadth and index, and it will be more legitimate to compare its lower value, found when those characters are omitted, as palatal measurements are available for few of the other series. The following classification is suggested:

A. Serbo-Croats and Greeks.

B. Bavarians (Altbayerisch), Badensians, Würtemberger and Alsatians.

C. Etruscans and Guanche.

D. English (Farringdon St.), English (Whitechapel) and Reihengräber.

With that arrangement, any particular series has a coefficient less than 7 with one, or more, of the other series in the same group and one greater than 7 with

TABLE I.

First Table of Coefficients of Racial Likeness ($\bar{n}_1 = 76—96$ *and* $\bar{n}_2 = 76—96$).

		Serbo-Croats (79·8)*	Greeks (89·7)	Bavarians (Alt-bayerisch) (79·0)	Badensians (93·3)	Würtem-berger (90·8)	Alsatians (95·0)	Etruscans (79·6)	Guanche (76·8)	English (Farringdon St.) (95·4)	English (White-chapel) (91·0)	Reihen-gräber (84·3)
Serbo-Croats (79·8)*	C.R.L.	—	6·14 ± ·18	11·71 ± ·21	17·60 ± ·20	16·41 ± ·21	35·54 ± ·27	17·37 ± ·20	24·15 ± ·19	53·03 ± ·19	47·18 ± ·19	56·24 ± ·19
	No. of Characters	—	27	20	22	20	11	22	25	25	24	23
Greeks (89·7)	C.R.L.	6·14 ± ·18	—	17·49 ± ·21	17·14 ± ·20	17·88 ± ·21	34·87 ± ·27	8·88 ± ·20	21·32 ± ·19	41·83 ± ·19	33·79 ± ·19	39·46 ± ·19
	No. of Characters	27	—	20	22	20	11	22	25	25	24	23
Bavarians (Altbayerisch) (79·0)	C.R.L.	11·71 ± ·21	17·49 ± ·21	—	6·45 ± ·19	7·53 ± ·19	6·74 ± ·27	23·09 ± ·20	27·75 ± ·20	42·14 ± ·19	49·29 ± ·19	56·67 ± ·19
	No. of Characters	20	20	—	23	25	11	22	22	24	23	25
Badensians (93·3)	C.R.L.	17·60 ± ·20	17·14 ± ·20	6·45 ± ·19	—	29·03 ± ·18†	0·80 ± ·27	11·35 ± ·18	14·10 ± ·19	18·66 ± ·19	22·62 ± ·19	32·51 ± ·18
	No. of Characters	22	22	23	—	26	11	27	25	25	24	26
Würtemberger (90·8)	C.R.L.	16·41 ± ·21	17·88 ± ·21	7·53 ± ·19	29·03 ± ·18†	—	2·81 ± ·27	12·21 ± ·19	15·37 ± ·19	30·45 ± ·19	40·65 ± ·19	47·15 ± ·18
	No. of Characters	20	20	25	26	—	11	23	23	25	24	26
Alsatians (95·0)	C.R.L.	35·54 ± ·27	34·87 ± ·27	6·74 ± ·27	0·80 ± ·27	2·81 ± ·27	—	10·10 ± ·26	13·45 ± ·27	26·34 ± ·26	39·70 ± ·26	68·90 ± ·27
	No. of Characters	11	11	11	11	11	—	12	11	12	12	11
Etruscans (79·6)	C.R.L.	17·37 ± ·20	8·88 ± ·20	23·09 ± ·20	11·35 ± ·18	12·21 ± ·19	10·10 ± ·26	—	4·23 ± ·19	9·84 ± ·18	7·67 ± ·18	12·80 ± ·19
	No. of Characters	22	22	22	27	23	12	—	25	27	26	25
Guanche (76·8)	C.R.L.	24·15 ± ·19	21·32 ± ·19	27·75 ± ·20	14·10 ± ·19	15·37 ± ·19	13·45 ± ·27	4·23 ± ·19	—	8·88 ± ·17	7·70 ± ·18	13·63 ± ·18
	No. of Characters	25	25	22	25	23	11	25	—	29	27	26
English (Farringdon St.) (95·4)	C.R.L.	53·03 ± ·19	41·83 ± ·19	42·14 ± ·19	18·66 ± ·19	30·45 ± ·19	26·34 ± ·26	9·84 ± ·18	8·88 ± ·17	—	3·57 ± ·17	11·31 ± ·18
	No. of Characters	25	25	24	25	25	12	27	29	—	29	28
English (Whitechapel) (91·0)	C.R.L.	47·18 ± ·19	33·79 ± ·19	49·29 ± ·19	22·62 ± ·19	40·65 ± ·19	39·70 ± ·26	7·67 ± ·18	7·70 ± ·18	3·57 ± ·17	—	5·56 ± ·18
	No. of Characters	24	24	23	24	24	12	26	27	29	—	26
Reihengräber (84·3)	C.R.L.	56·24 ± ·19	39·46 ± ·19	56·67 ± ·19	32·51 ± ·18	47·15 ± ·18	68·90 ± ·27	12·80 ± ·19	13·63 ± ·18	11·31 ± ·18	5·56 ± ·18	—
	No. of Characters	23	23	25	26	26	11	25	26	28	26	—

* The numbers in brackets following the designations of the series are the mean numbers of skulls ($\bar{n}$) available for the characters used in computing the coefficients.

† This coefficient becomes 2·14 if three palatal measurements are omitted: see pp. 342—344 below.

every series in the other three groups. Not all the coefficients between series in the same group are less than 7, but, apart from that between Badensians and Würtemberger, there are only two exceptions to that rule. They are the coefficient of 7·53 between Bavarians (Altbayerisch) and Würtemberger and that of 11·31 between the English (Farringdon St.) and Reihengräber. In a general way, the relationships* between the groups seem to be such that *D* is widely removed from both *A* and *B*, while *B* is distinctly removed from *A*.

The *C* group apparently occupies an intermediate position and its bond with the *D* is more intimate than that between any other pair of groups. But, at the same time, the *C* is not widely removed from either the *A* or *B*. Considering the coefficients less than 10 between members of different groups, we find that the following pairs are linked: Greek and Etruscans, Etruscans and both English series, and Guanche and both English series. The close connection of the *C* and *D* groups is again emphasised. It will only be possible to estimate the value of the arrangement suggested by comparing these with other series. The discovery of intermediate types may render it difficult, if possible at all, to maintain the division into distinct categories.

A group of 10 series has $\bar{n}$'s ranging from 49 to 67. Their coefficients with the ones already dealt with are given in Table II, and it will be safe to compare directly all the values given in that table. But a coefficient there will indicate a rather less close degree of relationship than one of the same magnitude would in Table I. In order to continue the method of grouping which has been tentatively adopted, it will be necessary to fix a different limiting value such that a coefficient less than it will justify the inclusion of the two series in the same group. That limit, which was 7 in Table I, may be adjusted in the following way. The $\bar{n}$'s in Table I range from 76 to 96 and the mid-range is 86. In Table II the mid-range of the $\bar{n}$'s is 58. The mean value of $\frac{\bar{n}_1 \bar{n}_2}{\bar{n}_1 + \bar{n}_2}$ in the first table may be taken to be $43\left(=\frac{86 \times 86}{86+86}\right)$ and in the second it will be $35\left(=\frac{86 \times 58}{86+58}\right)$. So a coefficient of 7 in Table I may be supposed to correspond to one of $5{\cdot}7\left(=\frac{35}{43} \times 7\right)$ in Table II. Then both Turks and Slovenes can be assigned without question to the *A* group, from their low coefficients with the Serbo-Croats and Greeks. That group is again found to be fairly close and almost equally related to both the *B* and the *C*, but it is widely removed from the *D* group. The Italians (Siena) show no coefficients less than 5·7 so they cannot, as yet, be assigned to any one of the categories distinguished. Their lowest coefficient is with the Greeks of the *A* group. The Swiss (Sierre) series may be placed in the *B* group, its coefficients with the Bavarians (Altbayerisch) and Badensians being both of a low order. The Pompeians have one coefficient less than 5·7 with the Badensians of the *B* group and two of a still

* In this section of the paper we may speak of series having different degrees of proximity or relationship to one another without meaning to imply that the scale by which the inter-relations are measured is indicative of true blood relationship.

TABLE II.

Second Table of Coefficients of Racial Likeness ($\bar{n}_2 = 76—96$ *and* $\bar{n}_1 = 49—67$).

$\bar{n}_1$ group.

$\bar{n}_2$ group.		Turks (67·0)	Slovenes (59·6)	Italians (Siena) (50·0)	Swiss (Sierre) (61·0)	Pompeians (52·3)	French (56·0)	Bohemians (Mediaeval) (49·8)	British Iron Age (52·3)	Sardinians (59·8)	Predynastic Egyptians (66·1)
Serbo-Croats (79·8)	C.R.L.	4·56 ± ·19	5·59 ± ·21	16·58 ± ·32	17·68 ± ·19	13·40 ± ·20	22·99 ± ·22	25·38 ± ·22	32·14 ± ·21	83·26 ± ·24	58·83 ± ·19
	No. of Characters	24	20	8	23	22	17	17	20	15	25
Greeks (89·7)	C.R.L.	2·38 ± ·19	6·06 ± ·21	8·23 ± ·32	18·14 ± ·19	7·80 ± ·20	16·81 ± ·22	17·79 ± ·22	20·41 ± ·21	51·82 ± ·24	38·83 ± ·19
	No. of Characters	24	20	8	23	22	17	17	20	15	25
Bavarians (Altbayerisch) (79·0)	C.R.L.	16·11 ± ·22	8·92 ± ·21	21·86 ± ·32	2·44 ± ·21	10·60 ± ·22	17·79 ± ·20	29·52 ± ·23	33·39 ± ·23	116·30 ± ·26	69·38 ± ·19
	No. of Characters	17	20	8	19	18	22	16	16	12	24
Badensians (93·3)	C.R.L.	18·56 ± ·21	14·54 ± ·19	20·49 ± ·32	2·72 ± ·20	4·17 ± ·20	12·33 ± ·19	21·34 ± ·22	16·95 ± ·21	62·74 ± ·24	62·86 ± ·19
	No. of Characters	19	24	8	22	21	23	18	19	14	25
Würtemberger (90·8)	C.R.L.	17·42 ± ·22	17·45 ± ·19	17·40 ± ·32	5·93 ± ·21	7·44 ± ·21	12·98 ± ·19	32·65 ± ·23	26·47 ± ·22	83·38 ± ·26	71·59 ± ·19
	No. of Characters	17	24	8	20	19	25	16	17	12	25
Alsatians (95·0)	C.R.L.	32·83 ± ·29	16·99 ± ·27	23·89 ± ·36	12·37 ± ·27	7·09 ± ·30	5·44 ± ·27	33·46 ± ·27	27·52 ± ·29	83·24 ± ·29	86·19 ± ·26
	No. of Characters	10	11	6	11	9	11	11	10	10	12
Etruscans (79·6)	C.R.L.	14·54 ± ·21	11·47 ± ·20	13·60 ± ·32	7·90 ± ·20	1·94 ± ·20	5·95 ± ·21	8·43 ± ·22	4·44 ± ·21	29·44 ± ·24	24·22 ± ·18
	No. of Characters	19	22	8	22	21	20	18	19	14	27
Guanche (76·8)	C.R.L.	28·50 ± ·20	18·47 ± ·19	20·23 ± ·32	16·66 ± ·19	2·76 ± ·19	6·36 ± ·21	13·56 ± ·22	3·41 ± ·20	29·21 ± ·24	25·66 ± ·17
	No. of Characters	22	23	8	25	23	20	17	22	14	29
English (Farringdon St.) (95·4)	C.R.L.	53·23 ± ·20	42·17 ± ·19	51·84 ± ·32	27·77 ± ·19	7·93 ± ·19	19·80 ± ·20	20·80 ± ·23	3·22 ± ·20	25·62 ± ·24	26·78 ± ·17
	No. of Characters	22	25	8	24	23	22	16	21	14	31
English (Whitechapel) (91·0)	C.R.L.	47·46 ± ·20	43·30 ± ·19	47·22 ± ·32	31·10 ± ·19	7·29 ± ·19	28·77 ± ·20	11·52 ± ·23	0·44 ± ·20	13·86 ± ·24	18·76 ± ·17
	No. of Characters	21	23	8	24	23	21	16	21	14	29
Reihengräber (84·3)	C.R.L.	56·89 ± ·21	42·92 ± ·19	58·58 ± ·32	34·09 ± ·20	15·71 ± ·20	25·96 ± ·19	5·74 ± ·23	4·22 ± ·21	16·25 ± ·24	18·66 ± ·18
	No. of Characters	20	25	8	22	21	23	16	19	14	28

lower order with the Etruscans and Guanche. This is the first case found of a type having close enough bonds with members of two different groups to entitle it to be included in both, so it is no longer possible to segregate the groups as definitely as it was from the evidence of Table I. As their closest bonds are with the Etruscans and Guanche, the Pompeians may be placed in the *C* group, but, lacking those comparisons, they would have been supposed a member of the *B* group. The French, again, show closest affinities with members of both the *B* and *C* groups. Their lowest coefficient is with the Alsatians, that being the only one less than 5·7, but the comparison is of uncertain value as so few characters are available. The position of the French series must be considered provisionally undetermined. The Mediaeval Bohemians are in a similar position unless their coefficient with the Reihengräber (5·74) may be supposed to constitute them a member of the *D* group. The comparison with the British Iron Age series is particularly noteworthy on account of the evidence of its close association with both Etruscans and Guanche of the *C* group, but its still closer one with the representatives of the *D* group—the two English series and the Reihengräber. The coefficient with the English (Whitechapel) is the only insignificant one in Tables I and II*. The British Iron Age is another example of a series which has a bond with two different groups close enough to entitle it to be a member of both of them. As its closest affinities are with the members of the *D* it will be included in that one. Both Sardinians and Predynastic Egyptians are widely removed from all the other series, and they cannot be placed in any one of the four categories hitherto distinguished. At the same time their coefficients with any particular one of the other series are remarkably alike and this suggests that the two aberrant types are closely related to one another.

It will be realised that we are already in difficulties in attempting to partition the series into groups by the method which provided a unique solution when applied to the data in Table I. If a coefficient less than a certain value is supposed to establish a bond which will indicate that the two series are members of the same group, then some series are found which may claim to be members of two different groups. Two such have as yet been found—the Pompeians and British Iron Age—and in both cases it was possible to decide definitely to which group the series shows a closer approach by considering all its coefficients with members of the two. The following arrangement is arrived at:

A. Serbo-Croats, Greeks, Turks, Slovenes, ? Italians (Siena).

B. Bavarians (Altbayerisch), Badensians, Würtemberger, Alsatians, Swiss (Sierre).

B or *C*. French.

C. Etruscans, Guanche, Pompeians.

D. English (Farringdon St.), English (Whitechapel), Reihengräber, British Iron Age, ? Bohemians (Mediaeval).

Unclassified: Predynastic Egyptians, Sardinians.

* A coefficient will be considered insignificant if it differs from zero by less than four times its probable error.

TABLE III.

Third Table of Coefficients of Racial Likeness ($\bar{n}_1 = 49—67$ *and* $\bar{n}_2 = 49—67$).

		Slovenes (59·6)	Turks (67·0)	Italians (Siena) (50·0)	Swiss (Sierre) (61·0)	Pompeians (52·3)	French (56·0)	Bohemians (Mediaeval) (49·8)	British Iron Age (52·3)	Predynastic Egyptians (66·1)	Sardinians (59·8)
Slovenes (59·6)	C.R.L.	—	3·29 ± ·22	6·70 ± ·32	9·13 ± ·21	10·31 ± ·22	8·78 ± ·19	23·53 ± ·23	27·16 ± ·22	45·12 ± ·19	59·97 ± ·24
	No. of Characters	—	17	8	19	18	24	16	18	25	14
Turks (67·0)	C.R.L.	3·29 ± ·22	—	10·81 ± ·32	16·64 ± ·21	13·74 ± ·21	21·15 ± ·24	29·91 ± ·24	31·63 ± ·22	51·84 ± ·20	81·93 ± ·26
	No. of Characters	17	—	8	20	19	14	14	17	22	12
Italians (Siena) (50·0)	C.R.L.	6·70 ± ·32	10·81 ± ·32	—	15·30 ± ·32	5·29 ± ·32	9·63 ± ·32	24·50 ± ·32	26·55 ± ·32	40·72 ± ·32	62·67 ± ·36
	No. of Characters	8	8	—	8	8	8	8	8	8	6
Swiss (Sierre) (61·0)	C.R.L.	9·13 ± ·21	16·64 ± ·21	15·30 ± ·32	—	11·18 ± ·19	10·22 ± ·22	18·23 ± ·23	16·62 ± ·20	52·63 ± ·19	61·95 ± ·24
	No. of Characters	19	20	8	—	23	17	16	22	24	14
Pompeians (52·3)	C.R.L.	10·31 ± ·22	13·74 ± ·21	5·29 ± ·32	11·18 ± ·19	—	1·61 ± ·23	11·07 ± ·24	4·63 ± ·21	20·94 ± ·19	23·68 ± ·25
	No. of Characters	18	19	8	23	—	16	14	20	23	13
French (56·0)	C.R.L.	8·78 ± ·19	21·15 ± ·24	9·63 ± ·32	10·22 ± ·22	1·61 ± ·23	—	15·29 ± ·23	8·81 ± ·23	39·50 ± ·20	31·65 ± ·26
	No. of Characters	24	14	8	17	16	—	16	16	22	12
Bohemians (Mediaeval) (49·8)	C.R.L.	23·53 ± ·23	29·91 ± ·24	24·50 ± ·32	18·23 ± ·23	11·07 ± ·24	15·29 ± ·23	—	6·23 ± ·24	18·48 ± ·23	21·27 ± ·25
	No. of Characters	16	14	8	16	14	16	—	15	16	13
British Iron Age (52·3)	C.R.L.	27·16 ± ·22	31·63 ± ·22	26·55 ± ·32	16·62 ± ·20	4·63 ± ·21	8·81 ± ·23	6·23 ± ·24	—	17·39 ± ·20	13·88 ± ·24
	No. of Characters	18	17	8	22	20	16	15	—	21	14
Predynastic Egyptians (66·1)	C.R.L.	45·12 ± ·19	51·84 ± ·20	40·72 ± ·32	52·63 ± ·19	20·94 ± ·19	39·50 ± ·20	18·48 ± ·23	17·39 ± ·20	—	2·13 ± ·24
	No. of Characters	25	22	8	24	23	22	16	21	—	14
Sardinians (59·8)	C.R.L.	59·97 ± ·24	81·93 ± ·26	62·67 ± ·36	61·95 ± ·24	23·68 ± ·25	31·65 ± ·26	21·27 ± ·25	13·88 ± ·24	2·13 ± ·24	—
	No. of Characters	14	12	6	14	13	12	13	14	14	—

A close bond—actually a coefficient less than 7 in Table I, or less than 5·7 in Table II—is shown between every series and one, or more, of the series in the same group. A relationship of that order may be called a "group-bond" and only three such have been found between members of different groups, viz. that between the Pompeians and Badensians, and those between the British Iron Age series on the one hand and the Etruscans and Guanche on the other. To facilitate the comparison of the different groups it is convenient to define a second degree of relationship which is less intimate than the "group-bond" but still of a low order. This was represented by a coefficient in Table I lying between 7 and 10, and the corresponding limits for Table II will be 5·7 and 8·1. Coefficients within these ranges will be supposed to link up pairs of series belonging to different groups. Several such "links" have already been noted from the evidence of Table I and the following additional ones are given by the coefficients in Table II: Swiss (Sierre) and Etruscans, Pompeians and Greeks, Pompeians and Würtemberger, Pompeians and Alsatians, Pompeians and both English series. It has, so far, been possible to make a perfectly clear distinction between the *A*, *B* and *D* groups. The *C* group, however, shows connections with all three and particularly intimate ones with the *D* group. It is not possible to maintain any sharp line of division between these two, but, nevertheless, it seems advisable to keep them as distinct as possible as their relations to the *A* and *B* groups are very different. A good illustration of the fact that the *C* group occupies a central position with regard to the other three is afforded by the inter-relations of both Etruscans and Pompeians. These two series are very similar to one another and they both show close connections with one or more members of the *A*, *B* and *D* groups.

The method of classification which was suggested by the coefficients in Table I will be applied to the data in all the other Tables (III—XV), the limits defining "group-bonds" and "links" being adjusted in every case to allow for the varying $\bar{n}$'s. It will be realised that in adopting that method we are relying almost entirely on the evidence afforded by close relationships; the varying degrees of more distant similarity have, necessarily, to be almost entirely neglected. A more rapid comparison of the new material will suffice, and this may be most easily followed by referring to Fig. 2, p. 329, which shows the grouping and inter-connections of the groups. Table III gives the coefficients between the series, one with another, having $\bar{n}$'s ranging from 49 to 67. A value less than 4·7 will now constitute a "group-bond" and one between 4·7 and 6·7 will indicate a "link." The Slovenes and Turks are seen to be closely allied and they were previously considered to be members of the same (*A*) group. The Italians (Siena) must remain unattached to any group though they are not far removed from some members of both the *A* and *C* groups. The Swiss (Sierre) series stands apart from all others in Table III, and it was previously considered to be the only member of the *B* group represented there. The coefficient between the Pompeians and French is remarkably low and, whereas the position of the latter was previously uncertain, it may now be included in the *C* group with safety. The Mediaeval Bohemians are again found to be closer to a member of the *D* group than to any other series,

but they still show no "group-bonds" and the orientation of the series must remain unsettled. From the indirect evidence of Table II it was suggested that Predynastic Egyptians and Sardinians were of a very similar type. A direct comparison confirms that supposition and it will be necessary to assign them to a new group which may be labelled *E*. The comparisons as yet made suggest that the *E* stands closer to the *D* than to any other group. The only new connection between members of different groups is one concerning the Pompeians and British Iron Age series, and in that case the coefficient is just low enough to be of the order of a "group-bond." But the other relationships of these show clearly that the two must be assigned to different groups. The division between the *C* and *D* groups is again found to be somewhat nebulous.

Table IV introduces eight new series having $\bar{n}$'s ranging from 30 to 42: they are there compared with the ones dealt with in Table I. A coefficient less than 4·1 will constitute a "group-bond" and one between 4·1 and 5·8 may be taken to indicate a "link." Thus the Rumanians may be assigned definitely to the *A* group and the Austrians (Mediaeval), Anglo-Saxons, Swedish Prehistoric and British Neolithic series can all be attached to the *D*. The last four have low coefficients with both English series—each resembling the Whitechapel more closely than the Farringdon St. type—and significantly lower ones with the Reihengräber. The two contemporary London series (Table I) must be supposed to stand farther apart from one another than the Reihengräber does from the Mediaeval Austrians, Anglo-Saxons or Swedish Prehistoric. The Bavarians (Waischenfeld) show no "group-bonds," but two coefficients of a slightly greater order with the Bavarians (Altbayerisch) and Würtemberger suggest a close connection with the *B* group. The position of the Copts must also remain undecided. In the Basques we have another example of a series showing close affinities with members of two different groups; it being bound to the Etruscans of the *C* and the English (Farringdon St.) of the *D* group. Further comparisons will be needed to show whether the Basques should be attached to one rather than to the other, but it may be noted now that their coefficients with the six upper series in the table (of the *A* and *B* groups) are all of a decidedly lower order than the corresponding coefficients between the Austrians (Mediaeval), Anglo-Saxons, Swedish Prehistoric and British Neolithic and the same six series. Such a closer approach to the *A* and *B* groups has to be recognised as a criterion which entitles a series to be placed in the *C* group when it is otherwise uncertain whether it belongs to the *C* or *D**. The division between the two last is admittedly vague although all other pairs can be differentiated far more clearly. From the evidence of Table IV, the only "link" found is one between the Rumanians and Etruscans.

Table V compares the eight series having $\bar{n}$'s ranging from 30 to 42 with the ten having $\bar{n}$'s from 49 to 67. A "group-bond" will be indicated by a coefficient less

* The Copts in Table IV, and both Copts and Basques in Tables V and VI, will also be seen to stand distinctly closer to series of the *A* and *B* groups than the Austrians (Mediaeval), Anglo-Saxons, Swedish Prehistoric and British Neolithic of the *D* group do to the same series.

TABLE IV.

Fourth Table of Coefficients of Racial Likeness ($\bar{n}_1 = 30—42$ *and* $\bar{n}_2 = 76—96$).

$\bar{n}_1$ group.

$\bar{n}_2$ group.		Rumanians (40·0)	Bavarians (Waischenfeld) (39·1)	Copts (37·4)	Basques (34·7)	Austrians (Mediaeval) (41·5)	Anglo-Saxons (36·4)	Swedish Prehistoric (41·6)	British Neolithic (30·1)
Serbo-Croats (79·8)	C.R.L.	4·31 ± ·19	18·57 ± ·25	24·35 ± ·21	21·75 ± ·19	54·86 ± ·32	27·54 ± ·19	37·23 ± ·21	44·18 ± ·19
	No. of Characters	24	13	19	24	8	24	19	23
Greeks (89·7)	C.R.L.	3·42 ± ·19	23·87 ± ·25	14·91 ± ·21	15·70 ± ·19	32·63 ± ·32	19·41 ± ·19	25·09 ± ·21	31·63 ± ·19
	No. of Characters	24	13	19	24	8	24	20	23
Bavarians (Altbayerisch) (79·0)	C.R.L.	8·88 ± ·22	4·56 ± ·21	21·99 ± ·20	16·67 ± ·19	52·62 ± ·32	35·02 ± ·19	39·57 ± ·20	48·18 ± ·20
	No. of Characters	17	19	21	23	8	23	21	21
Badensians (93·3)	C.R.L.	12·16 ± ·21	6·41 ± ·24	12·09 ± ·21	6·80 ± ·19	28·14 ± ·30	19·94 ± ·19	25·90 ± ·20	29·50 ± ·19
	No. of Characters	19	15	19	24	9	24	21	24
Würtemberger (90·8)	C.R.L.	11·47 ± ·22	4·11 ± ·22	10·70 ± ·20	9·93 ± ·19	40·89 ± ·30	28·84 ± ·19	36·37 ± ·20	42·07 ± ·20
	No. of Characters	17	17	21	24	9	24	21	22
Alsatians (95·0)	C.R.L.	17·28 ± ·29	6·29 ± ·29	8·79 ± ·26	7·96 ± ·26	39·24 ± ·36	30·27 ± ·26	31·67 ± ·26	54·47 ± ·27
	No. of Characters	10	10	12	12	6	12	12	11
Etruscans (79·6)	C.R.L.	5·36 ± ·21	19·70 ± ·24	6·10 ± ·21	3·57 ± ·18	7·26 ± ·30	5·99 ± ·18	9·16 ± ·21	18·90 ± ·19
	No. of Characters	19	14	20	26	9	26	20	24
Guanche (76·8)	C.R.L.	13·04 ± ·20	20·05 ± ·24	8·13 ± ·21	4·98 ± ·18	8·48 ± ·30	7·05 ± ·18	7·41 ± ·21	13·08 ± ·18
	No. of Characters	22	14	19	28	9	28	20	26
English (Farringdon St.) (95·4)	C.R.L.	31·10 ± ·20	32·00 ± ·23	6·42 ± ·19	2·90 ± ·17	9·72 ± ·30	4·63 ± ·17	12·76 ± ·20	8·40 ± ·18
	No. of Characters	22	16	23	30	9	30	22	26
English (Whitechapel) (91·0)	C.R.L.	27·29 ± ·20	44·30 ± ·23	9·99 ± ·19	4·76 ± ·17	4·25 ± ·29	2·96 ± ·18	4·68 ± ·20	4·98 ± ·18
	No. of Characters	21	16	23	29	10	28	21	26
Reihengräber (84·3)	C.R.L.	31·68 ± ·21	56·93 ± ·22	12·68 ± ·20	6·52 ± ·18	1·93 ± ·30	1·15 ± ·18	1·31 ± ·19	2·74 ± ·19
	No. of Characters	20	17	22	27	9	27	23	24

than 3·6 and a "link" by one between 3·6 and 5·1. Several relations already found are confirmed by these data, such as the attachment of the Rumanians to the *A* group and of the Austrians (Mediaeval), Anglo-Saxons and Swedish Prehistoric to the *D* group. Two of the three last show insignificant coefficients with the British Iron Age series. The Bavarians (Waischenfeld) still fail to give any values low enough to establish their claim to be a member of the *B* group. The position of the Copts was previously undecided, but from their close affinity with the Pompeians we can now have no hesitation in placing them in the *C* group. As in Table IV, the Basques again have an intimate bond with both a member of the *C* (Pompeians) and a member of the *D* group (British Iron Age). Their closer approach to the *A* and *B* types than is shown by undoubted members of the *D* group, however, seems to justify their inclusion in the *C* rather than in the *D* group. From its low coefficient with the Mediaeval Austrian series the contemporary Bohemian series can be accepted definitely as a member of the *D* group. The Predynastic Egyptians and Sardinians are again seen to be widely removed from all other series. No new connections are found between members of different groups except the one joining the Basques to the British Iron Age series which is intimate enough to be of the order of a "group-bond."

Table VI again confirms the arrangement suggested. It gives the inter-relations of the series having $\bar{n}$'s between 30 and 42. A coefficient less than 2·9 will indicate a "group-bond" and one between 2·9 and 4·2 a "link." The Rumanians and Bavarians (Waischenfeld) are supposed to be the only representatives in the table of the *A* and *B* groups respectively, hence it is satisfactory to find that neither is closely allied to any other series there. The Copts and Basques have their lowest coefficients with one another, and both are supposed to belong to the same (*C*) group. Several close bonds are found between the Austrians (Mediaeval), Anglo-Saxons, Swedish Prehistoric and British Neolithic series and such are expected between members of the same group. The Mediaeval Austrians have insignificant coefficients with both the Anglo-Saxon and Swedish Prehistoric series. No "links" are found between members of different groups.

There are four series having $\bar{n}$'s less than 30 but their means are not sufficiently well defined to justify any but the most tentative suggestions regarding their relationships to other types. Comparisons with the material already considered are given in Tables VII—X, and the following limits will define the two degrees of affinity indicated by the coefficients:

Table	VII	VIII	IX	X
Upper limit of "group-bond"	3·3	2·9	2·5	2·2
Upper limit of "link"	4·7	4·2	3·6	3·1

The English Bronze Age series shows few close connections with any other. The coefficient with the Swiss (Sierre) in Table VIII will justify its inclusion in the *B* group, but the absence of other "group-bonds" or "links" suggests that it is not a pure member of that group. The two Magyar series can be allotted to the *A* group with far more certainty. They show an insignificant coefficient with one

TABLE V.

Fifth Table of Coefficients of Racial Likeness ($\bar{n}_2 = 49—67$ *and* $\bar{n}_1 = 30—42$).

$\bar{n}_1$ group.

$\bar{n}_2$ group.		Rumanians (40·0)	Bavarians (Waischenfeld) (39·1)	Copts (37·4)	Basques (34·7)	Austrians (Mediaeval) (41·5)	Anglo-Saxons (36·4)	Swedish Prehistoric (41·6)	British Neolithic (30·1)
Slovenes (59·6)	C.R.L.	1·55 ± ·22	11·96 ± ·23	15·56 ± ·21	17·07 ± ·19	41·52 ± ·30	30·08 ± ·19	33·81 ± ·20	48·60 ± ·20
	No. of Characters	17	16	20	24	9	24	22	21
Turks (67·0)	C.R.L.	4·44 ± ·18	21·41 ± ·29	20·79 ± ·23	21·09 ± ·20	48·54 ± ·32	30·78 ± ·20	38·98 ± ·22	46·44 ± ·21
	No. of Characters	27	10	16	21	8	21	17	20
Italians (Siena) (50·0)	C.R.L.	6·07 ± ·32	22·07 ± ·36	11·37 ± ·32	16·82 ± ·32	23·44 ± ·32	36·68 ± ·32	34·59 ± ·32	62·64 ± ·32
	No. of Characters	8	6	8	8	8	8	8	8
Swiss (Sierre) (61·0)	C.R.L.	10·68 ± ·21	7·90 ± ·24	17·77 ± ·23	12·99 ± ·19	27·17 ± ·30	21·69 ± ·19	23·63 ± ·22	33·16 ± ·19
	No. of Characters	20	14	16	23	9	23	18	23
Pompeians (52·3)	C.R.L.	6·23 ± ·21	12·80 ± ·25	1·91 ± ·24	2·07 ± ·20	9·45 ± ·30	8·95 ± ·20	9·21 ± ·22	16·75 ± ·22
	No. of Characters	19	13	15	22	9	22	17	22
French (56·0)	C.R.L.	10·33 ± ·24	15·98 ± ·22	8·63 ± ·21	6·70 ± ·20	14·20 ± ·30	22·72 ± ·20	16·28 ± ·20	23·09 ± ·21
	No. of Characters	14	17	20	21	9	21	21	19
Bohemians (Mediaeval) (49·8)	C.R.L.	17·38 ± ·24	38·14 ± ·25	13·27 ± ·22	11·75 ± ·23	2·04 ± ·32	4·83 ± ·23	4·02 ± ·22	12·18 ± ·23
	No. of Characters	14	13	17	16	8	16	17	16
British Iron Age (52·3)	C.R.L.	20·06 ± ·22	33·56 ± ·24	8·06 ± ·23	1·98 ± ·20	0·75 ± ·30	1·97 ± ·20	0·70 ± ·22	4·99 ± ·20
	No. of Characters	17	14	16	21	9	21	17	21
Predynastic Egyptians (66·1)	C.R.L.	30·82 ± ·20	79·80 ± ·23	15·13 ± ·19	19·27 ± ·17	20·99 ± ·30	16·14 ± ·17	13·65 ± ·20	16·20 ± ·18
	No. of Characters	22	16	23	30	9	30	22	26
Sardinians (59·8)	C.R.L.	50·56 ± ·26	77·14 ± ·26	18·45 ± ·25	20·23 ± ·24	18·96 ± ·36	19·06 ± ·24	7·92 ± ·24	11·23 ± ·24
	No. of Characters	12	12	13	14	6	14	15	14

TABLE VI.

Sixth Table of Coefficients of Racial Likeness ($\bar{n}_1 = 30—42$ *and* $\bar{n}_2 = 30—42$).

		Rumanians (40·0)	Bavarians (Waischenfeld) (39·1)	Copts (37·4)	Basques (34·7)	Austrians (Mediaeval) (41·5)	Anglo-Saxons (36·4)	Swedish Prehistoric (41·6)	British Neolithic (30·1)
Rumanians (40·0)	C.R.L.	—	12·82 ± ·29	13·86 ± ·23	15·05 ± ·20	33·16 ± ·32	19·59 ± ·20	24·08 ± ·22	32·03 ± ·21
	No. of Characters	—	10	16	21	8	21	17	20
Bavarians (Waischenfeld) (39·1)	C.R.L.	12·82 ± ·29	—	11·06 ± ·23	12·99 ± ·23	55·45 ± ·33	35·49 ± ·23	45·91 ± ·23	59·20 ± ·24
	No. of Characters	10	—	16	16	7	16	16	14
Copts (37·4)	C.R.L.	13·86 ± ·23	11·06 ± ·23	—	3·08 ± ·19	11·30 ± ·30	9·57 ± ·19	13·86 ± ·21	16·14 ± ·21
	No. of Characters	16	16	—	24	9	23	20	19
Basques (34·7)	C.R.L.	15·05 ± ·20	12·99 ± ·23	3·08 ± ·19	—	4·66 ± ·29	4·33 ± ·17	9·92 ± ·20	8·01 ± ·18
	No. of Characters	21	16	24	—	10	30	21	26
Austrians (Mediaeval) (41·5)	C.R.L.	33·16 ± ·32	55·45 ± ·33	11·30 ± ·30	4·66 ± ·29	—	1·03 ± ·30	0·30 ± ·32	9·01 ± ·29
	No. of Characters	8	7	9	10	—	9	8	10
Anglo-Saxons (36·4)	C.R.L.	19·59 ± ·20	35·49 ± ·23	9·57 ± ·19	4·33 ± ·17	1·03 ± ·30	—	3·83 ± ·20	2·73 ± ·18
	No. of Characters	21	16	23	30	9	—	21	26
Swedish Prehistoric (41·6)	C.R.L.	24·08 ± ·22	45·91 ± ·23	13·86 ± ·21	9·92 ± ·20	0·30 ± ·32	3·83 ± ·20	—	3·01 ± ·21
	No. of Characters	17	16	20	21	8	21	—	20
British Neolithic (30·1)	C.R.L.	32·03 ± ·21	59·20 ± ·24	16·14 ± ·21	8·01 ± ·18	9·01 ± ·29	2·73 ± ·18	3·01 ± ·21	—
	No. of Characters	20	14	19	26	10	26	20	—

another (Table X) and the Modern Magyars have an insignificant coefficient with the Slovenes (Table VIII). Both series have a "group-bond" with the Greeks (Table VII) and the Mediaeval Magyars also have one with the Turks (Table VIII). The only "link" found between either and a member of a group other than the *A* is that connecting the Modern Magyars and Etruscans (Table VII). The Spanish Bronze Age series can be assigned to the *D* group. Its coefficient with the Mediaeval Austrians (Table IX) is insignificant, but the only other "group-bond" shown is with the Etruscans of the *C* group. At the same time the Spanish Bronze Age series has connections of only a slightly greater order with several members of the *D* group (viz. with the English (Whitechapel), Bohemians (Mediaeval), British Iron Age and Swedish Prehistoric) and no others, even of the order of a "link," with the *C* group types other than the Etruscans. Its inclusion in the *D* group rather than in the *C* is hence justified.

Passing from these four inadequately defined types, we have in the remaining eight the most reliable material dealt with in the present paper. The $\bar{n}$'s of these series range from 99 to 857 and, although they are considered together in Tables XI—XV, it is not suggested that all the coefficients in any one of those tables may be compared with one another directly. It will be most convenient to follow the new series singly through the five tables. The limits defining the two degrees of affinity recognised will vary from table to table and they will also be appreciably different in any particular table for the several series with $\bar{n}$'s between 99 and 857. The Czechs are found to have "group-bonds" with the Slovenes (Table XII), Rumanians (Table XIII) and Modern Magyars (Table XIV) and as all three have been supposed members of the same (*A*) group the Czechs can be assigned definitely to that group. They also have an extraordinarily low coefficient with the Great Russians (Table XV), which must be taken to indicate a closer degree of resemblance than that between the two contemporary English series (Table I). An entirely different state of affairs is revealed by the coefficients with the Sicilians. That series has none low enough to constitute either a "group-bond" or a "link" with any one of the other 40 series. The values with the Maltese and Dynastic Egyptians (Table XV) are only slightly greater, however, than the upper limits defining a "link." With this evidence the Sicilians must be kept apart from the five groups hitherto distinguished, though their comparison with additional series may be expected to show some closer connections than any recorded here. The Tyrolese is another series which can be less definitely placed in one group or another than most. It has no "group-bonds" but four "links": three with members of the *B* group—the Bavarians (Altbayerisch), Bavarians (Waischenfeld) and Badensians —and the other with the Mediaeval Magyars of the *A* group. The Tyrolese will be considered as a member, though a somewhat doubtful one, of the *B* group. The position of the Great Russians can be determined far more positively. Their close affinity to the Czechs has already been noted. Other "group-bonds" are found with the Italians (Siena) and Rumanians. As a member of the *A* group, the Great Russians will be linked with the Etruscans, French and Pompeians of the *C*. The Vorarlberger have "group-bonds" with the Bavarians (Altbayerisch),

TABLE VII.

Seventh Table of Coefficients of Racial Likeness ($\bar{n}_1 = 24—29$ *and* $\bar{n}_2 = 76—96$).

$\bar{n}_1$ group.

$\bar{n}_2$ group.			English Bronze Age (28·2)	Magyars (Mediaeval) (27·6)	Magyars (Modern) (28·9)	Spanish Bronze Age (24·2)
Serbo-Croats (79·8)	C.R.L.	6·98 ± ·20	3·41 ± ·20	4·33 ± ·19	17·21 ± ·21
	No. of Characters	21	22	24	19
Greeks (89·7)	C.R.L.	11·94 ± ·20	3·15 ± ·20	3·05 ± ·19	11·32 ± ·21
	No. of Characters	21	22	24	19
Bavarians (Altbayerisch) (79·0)	C.R.L.	10·87 ± ·19	10·70 ± ·19	5·19 ± ·22	17·69 ± ·22
	No. of Characters	23	24	17	17
Badensians (93·3)	C.R.L.	7·48 ± ·19	10·36 ± ·20	6·41 ± ·21	11·86 ± ·21
	No. of Characters	24	21	19	19
Würtemberger (90·8)	C.R.L.	14·26 ± ·19	7·22 ± ·19	6·71 ± ·22	13·18 ± ·21
	No. of Characters	24	23	17	19
Alsatians (95·0)	C.R.L.	9·14 ± ·27	15·97 ± ·26	10·02 ± ·29	19·37 ± ·30
	No. of Characters	11	12	10	9
Etruscans (79·6)	C.R.L.	7·98 ± ·19	9·56 ± ·19	3·89 ± ·21	2·75 ± ·21
	No. of Characters	24	23	19	19
Guanche (76·8)	C.R.L.	7·40 ± ·19	9·02 ± ·20	6·82 ± ·20	6·02 ± ·20
	No. of Characters	25	22	22	22
English (Farringdon St.) (95·4)	C.R.L.	14·41 ± ·18	18·62 ± ·18	17·05 ± ·20	8·74 ± ·20
	No. of Characters	27	26	22	21
English (Whitechapel) (91·0)	C.R.L.	15·80 ± ·18	23·05 ± ·18	15·98 ± ·20	3·71 ± ·20
	No. of Characters	27	26	21	21
Reihengräber (84·3)	C.R.L.	19·12 ± ·18	16·54 ± ·19	17·49 ± ·21	5·52 ± ·21
	No. of Characters	26	24	20	19

TABLE VIII.

Eighth Table of Coefficients of Racial Likeness ($\bar{n}_1 = 24—29$ *and* $\bar{n}_2 = 49—67$).

$\bar{n}_1$ group.

$\bar{n}_2$ group.			English Bronze Age (28·2)	Magyars (Mediaeval) (27·6)	Magyars (Modern) (28·9)	Spanish Bronze Age (24·2)
Slovenes (59·6)	C.R.L.	17·56 ± ·25	6·24 ± ·20	0·74 ± ·22	13·05 ± ·23
	No. of Characters	13	21	17	16
Turks (67·0)	C.R.L.	12·48 ± ·22	2·03 ± ·21	11·51 ± ·18	21·03 ± ·23
	No. of Characters	18	19	27	16
Italians (Siena) (50·0)	C.R.L.	19·60 ± ·32	8·90 ± ·32	3·15 ± ·32	9·97 ± ·32
	No. of Characters	8	8	8	8
Swiss (Sierre) (61·0)	C.R.L.	1·59 ± ·20	5·46 ± ·21	8·16 ± ·21	19·01 ± ·20
	No. of Characters	22	19	20	22
Pompeians (52·3)	C.R.L.	7·13 ± ·21	5·54 ± ·22	4·52 ± ·21	4·97 ± ·21
	No. of Characters	20	18	19	19
French (56·0)	C.R.L.	21·66 ± ·20	13·73 ± ·21	6·30 ± ·24	5·36 ± ·23
	No. of Characters	21	20	14	16
Bohemians (Mediaeval) (49·8)	C.R.L.	11·53 ± ·23	11·17 ± ·22	10·73 ± ·24	3·73 ± ·24
	No. of Characters	16	17	14	15
British Iron Age (52·3)	C.R.L.	14·63 ± ·21	16·32 ± ·23	12·68 ± ·22	3·17 ± ·21
	No. of Characters	19	16	17	19
Predynastic Egyptians (66·1)	C.R.L.	38·67 ± ·18	25·61 ± ·18	21·14 ± ·20	6·83 ± ·20
	No. of Characters	27	26	22	21
Sardinians (59·8)	C.R.L.	53·80 ± ·24	46·64 ± ·25	35·47 ± ·26	7·68 ± ·27
	No. of Characters	14	13	12	11

Badensians and Swiss (Valais) and a low coefficient with the Würtemberger (Table XI), so they may be considered a typical member of the *B* group, while showing links with the Slovenes and Czechs of the *A* group. Very similar relation-

TABLE IX.

Ninth Table of Coefficients of Racial Likeness ($\bar{n}_1 = 24—29$ *and* $\bar{n}_2 = 30—42$).

$\bar{n}_1$ group.

$\bar{n}_2$ group.		English Bronze Age (28·2)	Magyars (Mediaeval) (27·6)	Magyars (Modern) (28·9)	Spanish Bronze Age (24·2)
Rumanians (40·0)	C.R.L.	8·31 ± ·22	3·22 ± ·21	4·78 ± ·18	10·32 ± ·23
	No. of Characters	18	19	27	16
Bavarians (Waischenfeld) (39·1)	C.R.L.	10·25 ± ·23	6·22 ± ·24	9·55 ± ·29	21·77 ± ·25
	No. of Characters	16	15	10	13
Copts (37·4)	C.R.L.	14·96 ± ·20	9·38 ± ·19	8·07 ± ·23	5·32 ± ·23
	No. of Characters	21	25	16	16
Basques (34·7)	C.R.L.	10·25 ± ·18	13·32 ± ·18	9·18 ± ·20	5·17 ± ·20
	No. of Characters	27	26	21	21
Austrians (Mediaeval) (41·5)	C.R L.	17·95 ± ·29	18·99 ± ·30	20·83 ± ·32	0·95 ± ·30
	No. of Characters	10	9	8	9
Anglo-Saxons (36·4)	C.R.L.	10·15 ± ·18	13·04 ± ·19	12·33 ± ·20	5·67 ± ·20
	No. of Characters	27	25	21	21
Swedish Prehistoric (41·6)	C.R.L.	18·23 ± ·20	16·55 ± ·21	16·21 ± ·22	2·86 ± ·24
	No. of Characters	22	20	17	15
British Neolithic (30·1)	C.R.L.	20·12 ± ·18	23·42 ± ·20	22·31 ± ·21	7·98 ± ·20
	No. of Characters	27	21	20	22

TABLE X.

Tenth Table of Coefficients of Racial Likeness ($\bar{n}_1 = 24—29$ *and* $\bar{n}_2 = 24—29$).

		English Bronze Age (28·2)	Magyars (Mediaeval) (27·6)	Magyars (Modern) (28·9)	Spanish Bronze Age (24·2)
English Bronze Age (28·2)	C.R.L.	—	4·82 ± ·19	4·90 ± ·22	11·14 ± ·20
	No. of Characters	—	23	18	21
Magyars (Mediaeval) (27·6)	C.R.L.	4·82 ± ·19	—	0·72 ± ·21	10·88 ± ·22
	No. of Characters	23	—	19	18
Magyars (Modern) (28·9)	C.R.L.	4·90 ± ·22	0·72 ± ·21	—	7·37 ± ·23
	No. of Characters	18	19	—	16
Spanish Bronze Age (24·2)	C.R.L.	11·14 ± ·20	10·88 ± ·22	7·37 ± ·23	—
	No. of Characters	21	18	16	—

ships are shown by the Swiss (Valais) series. Its "group-bonds" are with the Badensians, Vorarlberger, Swiss (Sierre) and Bavarians (Altbayerisch), and its only connection with groups other than the *B* is a "link" with the Slovenes. The Maltese

TABLE XI.

Eleventh Table of Coefficients of Racial Likeness ($\bar{n}_1 = 76—96$ *and* $\bar{n}_2 = 99—857$).

$\bar{n}_2$ group.

$\bar{n}_1$ group.		Czechs (99·5)	Sicilians (106·1)	Tyrolese (129·3)	Great Russians (157·0)	Vorarlberger (315·1)	Swiss (Valais) (335·9)	Maltese (439·4)	Egyptians (26th—30th Dynasties) (857·0)
Serbo-Croats (79·8)	C.R.L.	13·93 ± ·19	59·32 ± ·22	22·40 ± ·23	23·08 ± ·21	25·99 ± ·23	27·31 ± ·19	42·67 ± ·22	63·98 ± ·19
	No. of Characters	25	18	16	19	16	23	17	23
Greeks (89·7)	C.R.L.	14·30 ± ·19	35·87 ± ·22	34·10 ± ·23	13·07 ± ·21	33·34 ± ·23	35·86 ± ·19	20·39 ± ·22	37·39 ± ·19
	No. of Characters	25	18	16	19	16	23	17	23
Bavarians (Altbayerisch) (79·0)	C.R.L.	16·74 ± ·20	69·04 ± ·23	8·87 ± ·21	23·57 ± ·22	6·07 ± ·21	4·16 ± ·21	63·32 ± ·22	77·88 ± ·19
	No. of Characters	22	16	19	18	19	19	18	24
Badensians (93·3)	C.R.L.	17·56 ± ·19	51·10 ± ·22	12·02 ± ·22	21·56 ± ·21	9·10 ± ·22	11·01 ± ·20	47·30 ± ·22	48·80 ± ·19
	No. of Characters	25	17	18	20	18	22	18	25
Würtemberger (90·8)	C.R.L.	11·09 ± ·19	50·34 ± ·22	8·59 ± ·21	16·41 ± ·22	2·68 ± ·21	11·17 ± ·20	62·97 ± ·22	59·46 ± ·19
	No. of Characters	23	17	20	18	20	20	18	25
Alsatians (95·0)	C.R.L.	18·24 ± ·27	71·88 ± ·33	14·28 ± ·27	30·35 ± ·30	13·16 ± ·27	32·68 ± ·29	75·53 ± ·27	69·64 ± ·26
	No. of Characters	11	7	11	9	11	10	11	12
Etruscans (79·6)	C.R.L.	12·84 ± ·19	18·40 ± ·22	34·75 ± ·22	10·56 ± ·21	27·36 ± ·22	29·54 ± ·20	19·43 ± ·22	13·68 ± ·18
	No. of Characters	25	17	18	20	18	22	18	27
Guanche (76·8)	C.R.L.	15·63 ± ·17	35·88 ± ·21	39·59 ± ·22	23·01 ± ·22	34·37 ± ·22	47·17 ± ·19	34·65 ± ·22	18·95 ± ·18
	No. of Characters	31	20	18	18	18	25	18	27
English (Farringdon St.) (95·4)	C.R.L.	39·19 ± ·17	50·44 ± ·21	65·18 ± ·21	49·88 ± ·22	87·30 ± ·21	89·40 ± ·19	54·19 ± ·21	23·56 ± ·17
	No. of Characters	29	19	20	18	20	24	20	31
English (Whitechapel) (91·0)	C.R.L.	39·07 ± ·18	39·51 ± ·21	54·24 ± ·21	46·83 ± ·22	105·10 ± ·21	100·07 ± ·19	40·59 ± ·21	12·59 ± ·18
	No. of Characters	27	19	19	18	19	24	20	26
Reihengräber (84·3)	C.R.L.	56·62 ± ·18	40·17 ± ·22	93·45 ± ·21	69·81 ± ·22	139·69 ± ·21	145·52 ± ·20	30·91 ± ·21	19·19 ± ·18
	No. of Characters	26	17	20	18	20	22	20	28

have only two "group-bonds" (with the Mediaeval Bohemians and Spanish Bronze Age series) and one "link" (with the Dynastic Egyptians). They, and the Dynastic Egyptians, must clearly be relegated to the *D* group, for the latter has unexpected "group-bonds" with both the English (Whitechapel) and British Iron Age series and others with the Spanish Bronze Age series and Mediaeval Austrians. The Egyptians are also linked to the Copts, Etruscans and Pompeians of the *C* group.

(5) *An Arrangement of European Types based on Coefficients of Racial Likeness.* Having completed the individual comparisons of the 41 series, we may now consider as a whole the arrangement which has been suggested by the coefficients. That method has been to partition the series into groups such that, in general, a member of any one is more closely related to one or more members of the same group than it is to any members of other groups. In general, it has been found that all the series in any one group are fairly closely related to one another. To aid the comparison two grades of relationship were fixed arbitrarily: the first—called a "group-bond"—is any relationship more intimate than a certain fixed standard and the second—called a "link"—is any relationship less intimate than a "group-bond," but more intimate than another, and only slightly greater, standard value. In the foregoing comparison of single series our attention has been occupied almost exclusively with the evidence of close association. That has afforded a more rapid and, it would seem, a more reliable method of classification than any which paid greater regard to the varying degrees of distant relationship. But the condition that no two series in the same group should be markedly dissimilar must not be neglected. It may be noted that tl attempt to segregate groups of races is a reasonable procedure as it is not unlikely that they are actually grouped by their blood relationships in some such way. The arrangement suggested is shown in Fig. 2. Out of the 41 series, one—the Sicilians—stands apart, as it has not a single "group-bond" or "link." Two others—the Predynastic Egyptians and Sardinians—have an intimate bond with one another, but they show no other connections. The remaining 38 series have been divided into four groups. Fig. 2 shows all the close connections—"group-bonds" or "links"—between members of different groups: the "group-bonds" between members of the same group are given in Figs. 3—6. It will be seen from the latter that almost every series has at least one, and most have more than one, "group-bond" with series in the same group*; while several are found which have no close connections whatever with any series other than those in their own group. To achieve a perfectly logical consistency, we might define a group to be an assemblage of series such that each showed one or more "group-bonds" with other members of the same group and none whatever with members of different groups. Then the 38 series would fall into two groups; the *A* on the one hand and the combined *B*, *C* and *D* on the other and that arrangement would be so simple that we should have largely defeated our own ends. If the *C* were absent, however, it would be possible to

* The Bavarians (Waischenfeld) and Tyrolese, which are both considered to be members of the *B* group (Fig. 4), are the only two exceptions to that rule and their closest connections are but very slightly greater than a "group-bond."

TABLE XII.

Twelfth Table of Coefficients of Racial Likeness ($\bar{n}_1 = 49—67$ *and* $\bar{n}_2 = 99—857$).

$\bar{n}_1$ group.		$\bar{n}_2$ group. Czechs (99·5)	Sicilians (106·1)	Tyrolese (129·3)	Great Russians (157·0)	Vorarlberger (315·1)	Swiss (Valais) (335·9)	Maltese (439·4)	Egyptians (26th—30th Dynasties) (857·0)
Slovenes (59·6)	C.R.L.	5·64 ± ·19	26·92 ± ·24	28·85 ± ·21	7·29 ± ·24	9·21 ± ·21	10·36 ± ·21	27·77 ± ·21	38·39 ± ·19
	No. of Characters	23	14	20	15	20	19	20	25
Turks (67·0)	C.R.L.	12·60 ± ·20	46·50 ± ·24	28·36 ± ·25	13·41 ± ·23	31·19 ± ·25	23·58 ± ·21	39·35 ± ·24	53·20 ± ·21
	No. of Characters	22	15	13	16	13	20	14	20
Italians (Siena) (50·0)	C.R.L.	6·59 ± ·32	21·94 ± ·32	32·65 ± ·32	1·97 ± ·32	22·04 ± ·32	34·69 ± ·32	20·56 ± ·33	42·33 ± ·32
	No. of Characters	8	8	8	8	8	8	7	8
Swiss (Sierre) (61·0)	C.R.L.	14·98 ± ·19	36·91 ± ·21	14·74 ± ·23	17·17 ± ·22	11·16 ± ·23	4·01 ± ·18	37·97 ± ·23	43·04 ± ·20
	No. of Characters	24	20	16	18	16	28	16	22
Pompeians (52·3)	C.R.L.	8·69 ± ·19	23·45 ± ·21	22·87 ± ·24	7·92 ± ·22	15·76 ± ·24	25·16 ± ·19	13·04 ± ·24	9·42 ± ·20
	No. of Characters	23	. 19	15	17	15	23	15	21
French (56·0)	C.R.L.	9·60 ± ·21	15·96 ± ·24	37·79 ± ·21	7·25 ± ·24	16·14 ± ·21	27·52 ± ·22	33·44 ± ·22	23·77 ± ·20
	No. of Characters	20	14	20	15	20	17	18	22
Bohemians (Mediaeval) (49·8)	C.R.L.	28·36 ± ·23	20·63 ± ·25	45·40 ± ·23	23·36 ± ·22	48·81 ± ·23	52·99 ± ·23	5·64 ± ·24	12·14 ± ·23
	No. of Characters	16	13	16	17	16	16	15	16
British Iron Age (52·3)	C.R.L.	25·35 ± ·20	16·49 ± ·22	48·11 ± ·23	26·58 ± ·24	49·82 ± ·23	50·64 ± ·20	15·69 ± ·23	5·15 ± ·21
	No. of Characters	21	17	16	15	16	22	16	19
Predynastic Egyptians (66·1)	C.R.L.	46·26 ± ·17	15·93 ± ·21	133·47 ± ·21	56·00 ± ·22	141·98 ± ·21	122·48 ± ·19	32·71 ± ·21	16·69 ± ·17
	No. of Characters	29	19	20	18	20	24	20	31
Sardinians (59·8)	C.R.L.	69·31 ± ·24	14·81 ± ·30	134·75 ± ·26	64·56 ± ·26	134·47 ± ·26	145·56 ± ·24	33·17 ± ·24	15·94 ± ·24
	No. of Characters	14	9	12	12	12	14	14	14

TABLE XIII.

Thirteenth Table of Coefficients of Racial Likeness ($\bar{n}_1 = 30—42$ *and* $\bar{n}_2 = 99—857$.)

$\bar{n}_2$ group.

$\bar{n}_1$ group.		Czechs (99·5)	Sicilians (106·1)	Tyrolese (129·3)	Great Russians (157·0)	Vorarlberger (315·1)	Swiss (Valais) (335·9)	Maltese (439·4)	Egyptians (26th—30th Dynasties) (857·0)
Rumanians (40·0)	C.R.L.	2·91 ± ·20	28·56 ± ·23	25·49 ± ·25	4·56 ± ·23	15·26 ± ·25	14·32 ± ·21	15·72 ± ·24	26·57 ± ·21
	No. of Characters	22	16	13	16	13	20	14	20
Bavarians (Waischenfeld) (39·1)	C.R.L.	8·82 ± ·24	45·72 ± ·27	6·33 ± ·23	16·34 ± ·26	6·00 ± ·23	7·66 ± ·24	32·53 ± ·24	58·90 ± ·23
	No. of Characters	14	11	16	12	16	14	15	16
Copts (37·4)	C.R.L.	13·39 ± ·21	13·91 ± ·25	23·94 ± ·22	10·53 ± ·23	20·26 ± ·22	33·76 ± ·23	16·11 ± ·22	7·12 ± ·19
	No. of Characters	19	13	18	16	18	16	18	23
Basques (34·7)	C.R.L.	13·31 ± ·18	20·48 ± ·22	23·66 ± ·21	12·39 ± ·22	19·29 ± ·21	27·73 ± ·19	16·77 ± ·21	9·66 ± ·17
	No. of Characters	28	18	20	17	20	23	20	30
Austrians (Mediaeval) (41·5)	C.R.L.	47·94 ± ·30	15·91 ± ·30	58·89 ± ·30	38·23 ± ·32	72·92 ± ·30	82·11 ± ·30	12·22 ± ·33	5·39 ± ·30
	No. of Characters	9	9	9	8	9	9	7	9
Anglo-Saxons (36·4)	C.R.L.	27·37 ± ·18	28·14 ± ·22	41·43 ± ·21	33·55 ± ·22	53·63 ± ·21	54·21 ± ·19	18·17 ± ·21	10·41 ± ·17
	No. of Characters	28	18	20	17	20	23	20	30
Swedish Prehistoric (41·6)	C.R L.	32·04 ± ·21	13·45 ± ·25	64·10 ± ·21	36·00 ± ·23	64·94 ± ·21	59·18 ± ·20	11·03 ± ·21	8·61 ± ·20
	No. of Characters	20	13	19	16	19	21	19	22
British Neolithic (30·1)	C.R.L.	42·77 ± ·18	33·81 ± ·22	72·34 ± ·22	48·73 ± ·22	85·31 ± ·22	74·89 ± ·19	24·14 ± ·22	15·52 ± ·19
	No. of Characters	26	18	18	17	18	24	18	24

make that perfectly rigid distinction between the *A*, *B* and *D* groups. The *C* occupies a central position, and it is intimately connected with the *D* and rather more closely connected with both *A* and *B* groups than they are with one another. It was found difficult in some cases (especially with the Copts, Guanche and Basques) to decide whether a series should be placed in the *C* or *D* groups, and a closer approach to the *A* and *B* than members of the *D* group have in general has

TABLE XIV. *Fourteenth Table of Coefficients of Racial Likeness* ($\bar{n}_1 = 24—29$ *and* $\bar{n}_2 = 99—857$).

$\bar{n}_2$ group.

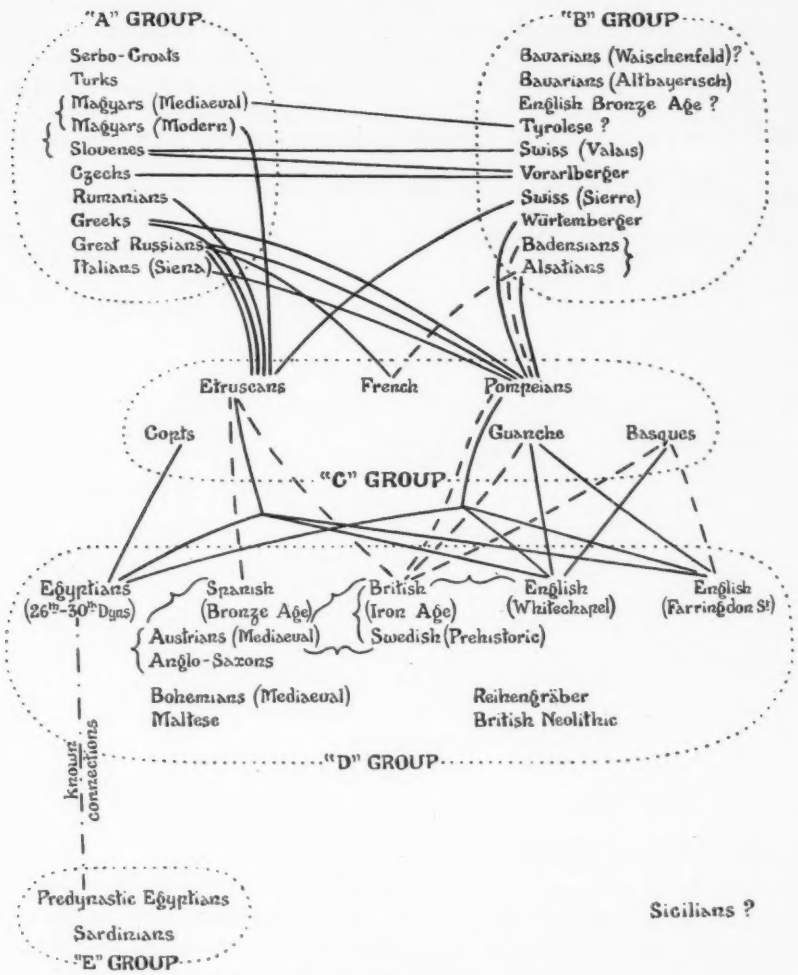
$\bar{n}_1$ group.		Czechs (99·5)	Sicilians (106·1)	Tyrolese (129·3)	Great Russians (157·0)
English Bronze Age (28·2)	C.R.L.	15·13 ± ·19	40·58 ± ·23	11·15 ± ·21	22·06 ± ·22
	No. of Characters	25	16	20	17
Magyars (Mediaeval) (27·6)	C.R.L.	7·45 ± ·20	25·89 ± ·23	4·62 ± ·22	10·04 ± ·21
	No. of Characters	22	16	18	19
Magyars (Modern) (28·9)	C.R.L.	2·92 ± ·20	23·31 ± ·24	14·27 ± ·25	4·17 ± ·23
	No. of Characters	22	15	13	16
Spanish Bronze Age (24·2)	C.R.L.	12·75 ± ·20	12·17 ± ·21	31·01 ± ·24	7·11 ± ·22
	No. of Characters	21	19	15	17

$\bar{n}_2$ group.

$\bar{n}_1$ group.		Vorarlberger (315·1)	Swiss (Valais) (335·9)	Maltese (439·4)	Egyptians (26th—30th Dynasties) (857·0)
English Bronze Age (28·2)	C.R.L.	22·85 ± ·21	9·71 ± ·20	27·17 ± ·21	31·44 ± ·18
	No. of Characters	20	22	20	27
Magyars (Mediæval) (27·6)	C.R.L.	8·76 ± ·22	7·17 ± ·21	19·03 ± ·22	19·95 ± ·18
	No. of Characters	18	19	18	26
Magyars (Modern) (28·9)	C.R.L.	9·04 ± ·25	11·27 ± ·21	8·03 ± ·24	15·63 ± ·21
	No. of Characters	13	20	14	20
Spanish Bronze Age (24·2)	C.R.L.	24·02 ± ·24	32·83 ± ·20	3·81 ± ·25	1·79 ± ·21
	No. of Characters	15	22	13	19

to be recognised as a criterion which would entitle the series to be placed in the central group rather than in the outlying one. When additional series are compared with the present material the divisions between the groups will almost certainly become less definite than they are at present. That is a condition to be expected from the nature of the problem, but, however arbitrary the method may be, it would still seem to serve a useful purpose by reducing to some order the tangle of inter-relationships.

INTER-RELATIONS OF GROUPS OF EUROPEAN RACES



– – – – Connections of the order of a 'group-bond'

——— " " " " " " 'link'

~~~ Pairs of series connected by a bracket show insignificant coefficients.

N.B. The arrangement of the series within a group is not intended to have any significance.

Fig. 2.
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It would clearly be idle to attempt to construct a two-dimensional diagram showing all the 41 series at distances from one another proportional to their relative degrees of affinity. But when the groups are considered separately that is not such a hopeless task since the numbers of series in the several groups are small. Figs. 3—6 deal with the groups *A*—*D* respectively and in them all the "group-bonds" are shown, most of the connections of the order of a "link" being omitted as they would confuse the diagrams. Fig. 3 gives the inter-relations of the *A* group series. The only pairs not connected by either a "group-bond" or a "link" are all possible ones between the Mediaeval Magyars, Serbo-Croats, Greeks and Turks on the one hand and the Great Russians, Czechs and Italians (Siena) on the other; and the

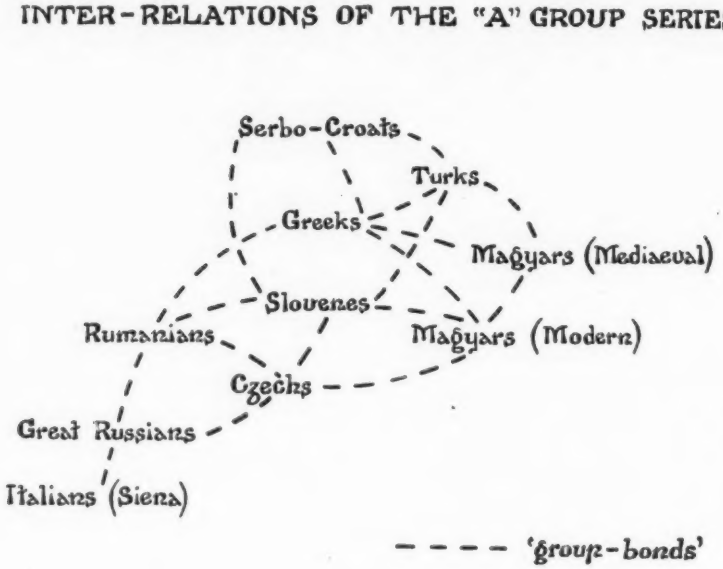


Fig. 3.

Rumanians and Modern Magyars, Rumanians and Italians (Siena), Slovenes and Mediaeval Magyars, Modern Magyars and Turks. No linear arrangement of the series is possible, but two sets may be contrasted—the Italians (Siena), Great Russians and Czechs at the one extreme and the Mediaeval Magyars, Serbo-Croats, Greeks and Turks at the other. The two are linked together by the Rumanians, Slovenes and Modern Magyars. The four upper series in Fig. 3 are in close geographical proximity, but it is surprising to find such a close association of the Great Russians with either the Czechs or Italians (Siena). The connection of the last with the *A* group may have to be relinquished when more abundant material is available. At present it has only one "group-bond" with its co-members while the Great Russians have two and the other series three, four or five each.

The inter-relations of the *B* group series are shown in Fig. 4. The Tyrolese and Bavarians (Waischenfeld) have been provisionally included in the group although they have no "group-bonds" with any other series. Their connections of the order of a "link" are given, but only the more intimate "group-bonds" are shown between the other series. The English Bronze Age type has only one "group-bond" and no "links" whatever with any other member of the *B* group, so its position is also very uncertain. Apart from these three questionable series, however, we have a group of seven with very close inter-connections, and that

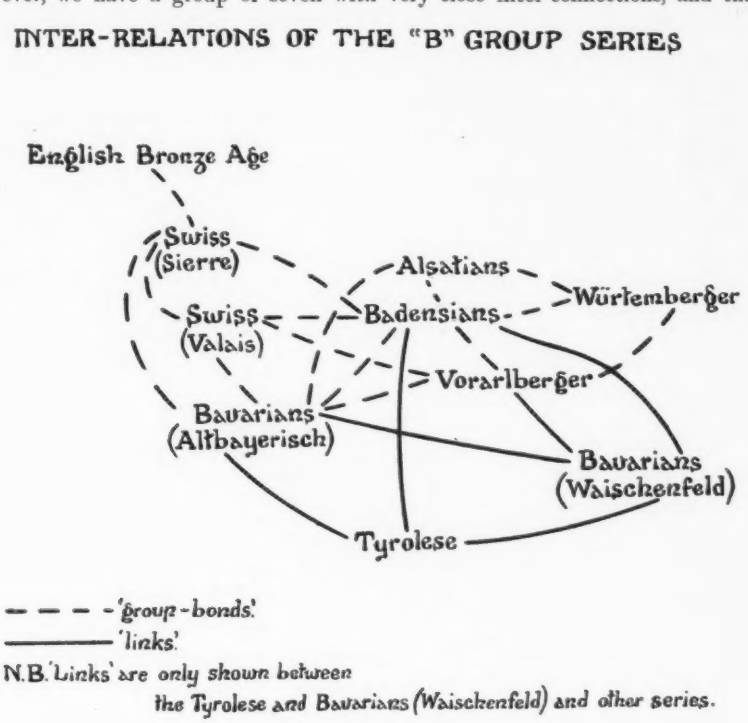


Fig. 4.

might have been expected from their geographical proximity. Each has three or more "group-bonds," and the Badensians have as many as six including an insignificant coefficient with the Alsatians. If the English Bronze Age, Bavarians (Waischenfeld) and Tyrolese series are excluded, the only pairs which are not connected by either a "group-bond" or a "link" are the Alsatians and Swiss (Valais) and the Alsatians and Swiss (Sierre). The spatial arrangement suggested by the coefficients seems to bear little relation to the geographical distribution, although the Alsatians, Badensians and Würtemberger are contiguous in both cases.

As the number of series is smaller, it is possible to show in a diagram (Fig. 5) without confusion all the "group-bonds" and "links" which connect the members of the *C* group. A wheel-like arrangement is suggested with the Pompeians and Etruscans at the hub and the Basques, Guanche, French and Copts at the terminals of spokes; each of the last four being more closely related to the two central series than they are to one another. The Copts stand rather apart from the others as they have no close connections whatever with the Etruscans, French and Guanche. The French and Basques form the only other pair not connected by either a "group-bond" or a "link." It is a significant fact that the Etruscans and Pompeians, which now take up a central position, are the two series which were previously found to have the closest and the largest number of connections with

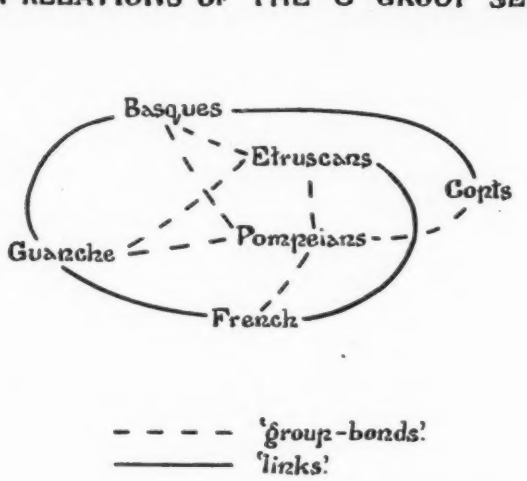


Fig. 5.

the *A*, *B* and *D* groups. A comparison of Figs. 2 and 5 will show that each member of the *C* group has closer connections within that group than it has with any other, while on examination a comparison of the numerical values of the coefficients provides fuller justification of the arrangement suggested.

The *D* group (Fig. 6) is characterised by the number and the closeness of its inter-connections. Six insignificant coefficients were found between pairs of the series in the group (see Fig. 2). Of the total 12, there are six which form a kernel, as it were, each being connected by a "group-bond" with every other, except one pair which is joined by a "link" instead of a "group-bond." They are the English (Whitechapel), British Iron Age, Anglo-Saxons, Reihengräber and Mediaeval Austrians; and the English (Whitechapel) and Mediaeval Austrian series are the only ones not connected by a coefficient of a lower order than a "link." The English (Farringdon St.)

branch off in one direction, being connected by "group-bonds" with only two of the central series. Branches in other directions are indicated by the British Neolithic, with two "group-bonds," and the Swedish Prehistoric series with three. It is surprising to find that the Dynastic Egyptians are so similar to three of the "kernel" types. The Spanish Bronze Age series and the Mediaeval Bohemians have only one such close connection each, and the Maltese have no "group-bonds" with any one of the six central series. Some of the peripheral types are widely separated from one another and the British Neolithic and Maltese are as far apart as any. The *E* group, comprising the Predynastic Egyptians and Sardinians, has shown no "group-bonds" or "links" with any *D* series but, from the evidence of other material, it is known that the former would be connected with the Dynastic Egyptians by a sequence of

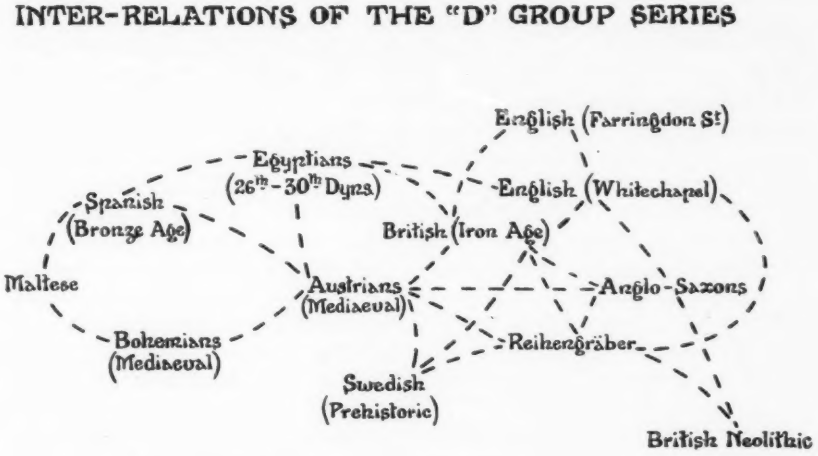


Fig. 6.

intermediate Egyptian types*. It is a most noteworthy fact that two of the series which form the kernel of the *D* group—viz. the British Iron Age and Whitechapel—are the ones most closely connected with members of the *C* group. From a comparison of Figs. 2 and 6 it is clear, however, that both have much closer connections within their own group than they have with the other. The position of the other English (Farringdon St.) series, with its weaker bonds within the *D* group, cannot be determined so positively. It may be noticed that the upper five series in Fig. 6 are the only ones showing any "group-bonds" or "links" with members of the *C* group.

In order to establish a basis for a reliable classification, it was thought necessary to calculate the coefficients between all possible pairs of the 41 series selected.

* See G. M. Morant: "A Study of Egyptian Craniology from Prehistoric to Roman Times," *Biometrika*, Vol. XVII. 1925, pp. 1—52.

It can now be seen that there was a real need for that precaution although, actually, little use has been made of most of the larger coefficients. The Pompeians have shown 15 close connections—"group-bonds" or "links"—with other series and the Etruscans 14, while, at the other extreme, some series have shown only one such connection, and the Sicilians have none at all. Without actually calculating the coefficients, it would have been quite unsafe to attempt to pick out all the pairs which would have a close relationship. Neither does it seem possible to gain any exact conception of the relationship of two series without comparing them directly. As an illustration of that point we may consider the evidence afforded by pairs of series which are so similar that they give a coefficient which does not differ from zero by more than four times its probable error. Nine of the 820 coefficients calculated were found to be of that order*. It might be thought that types which were so intimately bound together would necessarily have extremely similar relations to other series. That is by no means so, however. There are two insignificant coefficients between members of the *A* group, one for the *B* and six for the *D*. The Modern Magyars cannot be distinguished from the Slovenes when the available measurements are compared directly, but the former show one link with the *C* group and none with the *B*, and the latter have two links with the *B* group and none with the *C*. Again, the Alsatians of the *B* group have a "group-bond" with the French of the *C*, but the Badensians have no connections with the French. More striking examples are afforded by the series in the *D* group having insignificant coefficients. The British Iron Age series is intimately connected with three others in that way and, at the same time, it has four "group-bonds" with members of the *C* group. The almost identical English (Whitechapel) series has links only with the same four. But the Austrians (Mediaeval) and Swedish Prehistoric series, which are just as essentially bound to the British Iron Age series, have not a single "group-bond" or "link" with any member of the *C* group. It is difficult to judge how far these conditions are due to the inherent nature of the problem, and to what extent they depend on the inadequacy of the samples and on the fact that the numbers of characters available for the different series are not the same. While those limitations are imposed in practice, however, it is clear that due weight will have to be given to such considerations if an attempt is made to deal with additional material by the same methods. The discovery of an insignificant coefficient between a new series and one for which the relationships have already been determined will certainly show that the two are members of the same group, but it will be necessary to calculate a considerable number of coefficients in order to gain as complete a conception as possible of the affinities of the new series.

From a statistical point of view, the greatest weakness of the classification suggested lies in the inadequacy of the data. The assumption that a single sample of 50 to 100 skulls can give a fair representation of a racial type to which several million individuals may have conformed at any one time must always be a

* The pairs of series showing an insignificant coefficient are connected by a curled bracket in Fig. 2.

hazardous one. The drawing of another sample or samples from what is presumed to be the same population is the only means of testing its validity. It will be of interest to examine the degree of resemblance found in cases when that is thought to have been done. The two English series—the Farringdon St. and Whitechapel—were obtained from contemporary (17th century) and neighbouring London cemeteries. The coefficient between them (Table I) is $3{\cdot}57 \pm {\cdot}17$ and it indicates that the two are very similar, but by no means identical. A coefficient twice as great is the arbitrarily chosen upper limit of a "group-bond" for samples of that size. May the value found be taken to be of the order of one to be expected when two drawings are made from graveyards which are contemporary and archaeologically indistinguishable? Very much closer resemblances have been found between series of European and Asiatic Greeks and between groups of skulls from the same Swiss canton*. The nine insignificant coefficients noted are also of a decidedly lower order. Several of these pairs are known to have been derived from neighbouring, if not geographically identical, areas (such as the Magyar series and the Slovenes, or the Badensians and Alsatians) but others are widely separated in both space and time (such as the Spanish Bronze Age and Mediaeval Austrians, or the same Austrians and the Swedish Prehistoric). Other pairs of series which show a connection which is more intimate than that between the two English ones are: Würtemberger and Alsatians (Table I); Turks and Greeks, Swiss (Sierre) and Altbayerisch, Swiss (Sierre) and Badensians, Pompeians and Etruscans, Pompeians and Guanche (Table II); Pompeians and French, Predynastic Egyptians and Sardinians (Table III); Mediaeval Austrians and Reihengräber, Anglo-Saxons and Reihengräber, Swedish Prehistoric and Reihengräber (Table IV); Rumanians and Slovenes (Table V); Vorarlberger and Würtemberger (Table XI); Great Russians and Italians (Siena) (Table XII); and Czechs and Great Russians (Table XV). It may at least be expected that two series which are to bear the same ethnic label should resemble one another as closely as some of these pairs do. A reasonable demand in such a case would be for a coefficient of 2 between two samples each of 100 individuals, and perfectly insignificant coefficients ought to be found occasionally. The difference between the two London series must be supposed greater than any which is likely to occur under normal conditions of sampling from the same population. Before attempting to interpret the classification suggested by the coefficients of racial likeness in terms of presumed blood relationship, it will be advisable to consider the evidence afforded by a comparison of individual characters.

(6) *A Comparison of Individual Characters.* A classification of European races derived solely from statistical constants may appeal to biometricians, if the material be adequate, but it is not likely in the present state of our science to carry any conviction to anthropologists in general. The method usually adopted by the latter, when they have considered measurements at all, has been to consider a single character, or a binary or tertiary combination of characters, and to endeavour to find some self-evident relations between the measurements which might be presumed to

* See *Greeks* and *Swiss* in Appendix I.

delimit groups of allied races and to indicate the blood relationships between them. The character or characters chosen for that purpose (whether of the skeleton or living body) have been the ones which appeared, from a qualitative comparison, to be most capable of distinguishing the racial types. It has always been an assumption that any single measurement, or combination of a few measurements, would be found capable of performing this function. If the mixing of racial types has been very thorough and long continued, then it would not be at all surprising if a reliable clue to ethnic history could only be given by the skull as a whole, and not by any of its special attributes. By comparing at one time a considerable number of independent characters the method of the coefficient of racial likeness has an obvious advantage over that other method. But it is extremely probable, *à priori*, that some measurements are far more capable of differentiating racial types than others, and it would be of great interest to grade them according to their ability to serve that purpose. To do that with completeness the biometrician would require reliable determinations of all the intra- and inter-racial variabilities. An approximation to that order can be found, however, in an indirect way. The form of the coefficient of racial likeness which has been used may be written: $\frac{1}{M}S(\alpha)-1+\frac{1}{M}$, where $\alpha=\frac{(m_s-m_s')^2}{\sigma_s^{\,2}}\times\frac{n_s n_s'}{n_s+n_s'}$, i.e. the square of the difference of the means expressed in terms of the square of the standard deviation of that difference. The α's are calculated independently for every character available for both of the series compared, and from their values it can be seen at once whether the differences may have arisen as the result of random sampling, or whether they denote a real difference between the populations sampled. The mean value of the α's for a particular character will give an index of the ability of that character to differentiate the series compared. It will be roughly proportional to the inter-racial variation expressed in terms of the average intra-racial variation; the latter being supposed equal to that of the Farringdon St. English series as its standard deviations have been used throughout. For the most constant characters, that ratio will be small, and only the ones showing the largest values are likely to be of any value, by themselves, in distinguishing the various groups of racial types. As in the case of the coefficients, the α's will be affected appreciably by the magnitude of the n's in the series compared, and it will again be advisable to split up the whole material into groups having approximately equal $\bar{n}$'s. Mean α's for all the 31 characters, and for the various ranges of mean n's ($\bar{n}_1$ and $\bar{n}_2$) used when comparing the coefficients, are given in Table XVI. The right marginal distribution gives the mean α's for the various characters when no account is taken of the n's. It will be seen that the order in which the characters are thus arranged is very similar to the orders given by the other vertical arrays. Even when the number of comparisons is small, the incidence of large and small $\bar{\alpha}$'s is roughly the same, the smallest values being found in the upper part of the table, and the largest in the lower third. The lower marginal horizontal array gives the $\bar{\alpha}$'s, when all the characters are clubbed together, for different ranges of $\bar{n}_1$ and $\bar{n}_2$ and they increase with $\bar{n}_1\,\bar{n}_2/(\bar{n}_1+\bar{n}_2)$. The right marginal array may be supposed to arrange the characters in the order of their capacity to differentiate the 41 series compared,

TABLE XVI.

Mean α's for Different Characters and Differen

$\bar{n}_1$ / $\bar{n}_2$	*24—29* / *24—29*	*24—29* / *30—42*	*30—42* / *30—42*	*24—29* / *49—67*	*30—42* / *49—67*	*49—67* / *49—67*	*24—29* / *76—96*	*30—42* / *76—96*	*49—67* / *76—96*
100 *fmb*/*fml*	2·0 (6)	1·2 (16)	1·0 (6)	1·7 (16)	1·1 (16)	1·7 (6)	2·4 (40)	2·1 (40)	2·5 (40)
100 *NB*/*NH'*	1·1 (3)	3·1 (18)	3·4 (15)	3·2 (24)	5·0 (48)	6·6 (28)	2·5 (30)	3·0 (60)	4·1 (80)
fml	2·4 (6)	1·5 (20)	1·2 (10)	3·0 (20)	1·9 (25)	0·2 (10)	2·1 (40)	1·4 (50)	3·4 (50)
Aℒ	4·8 (1)	1·8 (10)	1·6 (10)	3·3 (14)	3·5 (50)	2·2 (21)	3·1 (16)	3·3 (40)	3·8 (56)
NB	4·0 (3)	5·6 (18)	4·8 (15)	6·5 (24)	4·7 (48)	6·4 (28)	4·5 (30)	4·1 (60)	4·7 (80)
Nℒ	2·8 (1)	4·7 (10)	6·0 (10)	2·5 (14)	6·1 (35)	5·2 (21)	3·3 (16)	5·1 (40)	5·6 (56)
LB	2·8 (6)	5·4 (28)	11·9 (21)	2·2 (36)	7·0 (63)	2·4 (36)	3·7 (44)	9·5 (77)	4·3 (99)
NH'	8·2 (3)	4·3 (18)	2·6 (15)	7·6 (24)	6·3 (48)	3·7 (28)	6·1 (33)	3·6 (66)	5·4 (88)
G'H	5·8 (3)	3·7 (21)	3·4 (21)	7·1 (27)	3·9 (63)	4·2 (36)	3·3 (33)	3·1 (77)	4·5 (99)
100 *G'H*/*GB*	2·7 (3)	3·4 (18)	4·3 (15)	3·1 (15)	5·1 (30)	7·6 (10)	4·8 (33)	5·2 (66)	8·8 (55)
C	4·2 (1)	2·5 (4)	0·9 (1)	4·2 (12)	5·0 (12)	8·9 (15)	3·7 (20)	0·9 (20)	7·8 (60)
fmb	0·3 (6)	0·4 (16)	0·4 (6)	3·0 (16)	2·4 (16)	2·0 (6)	0·9 (40)	1·2 (40)	7·7 (40)
Pℒ	—	7·0 (2)	4·6 (4)	0·7 (1)	9·9 (5)	—	2·1 (3)	7·7 (18)	9·7 (7)
O_2	8·6 (6)	5·6 (28)	5·1 (21)	6·9 (32)	5·5 (56)	8·1 (28)	7·4 (40)	5·2 (70)	6·6 (80)
100 O_2/O_1	9·6 (2)	6·0 (19)	3·0 (15)	17·6 (16)	10·5 (33)	16·4 (13)	11·5 (20)	6·0 (41)	15·7 (40)
100 G_2/G_1	3·0 (1)	13·8 (4)	5·9 (3)	48·4 (2)	6·4 (4)	10·3 (1)	12·0 (3)	3·8 (10)	25·5 (7)
H'	0·4 (6)	7·2 (32)	15·1 (28)	6·2 (40)	12·0 (80)	14·0 (45)	8·4 (44)	14·4 (88)	15·7 (110)
B'	4·5 (6)	3·8 (28)	4·7 (21)	7·9 (36)	9·7 (63)	17·9 (36)	5·0 (40)	7·5 (70)	13·9 (90)
S	6·8 (6)	12·4 (28)	16·6 (21)	7·6 (36)	20·7 (63)	11·7 (36)	7·8 (40)	16·5 (70)	15·0 (90)
U	9·2 (2)	5·9 (16)	7·0 (12)	17·7 (18)	22·3 (39)	15·9 (18)	11·3 (18)	11·1 (40)	18·6 (48)
J	20·0 (6)	20·6 (28)	8·0 (21)	25·7 (32)	15·0 (56)	29·0 (28)	15·0 (44)	13·8 (77)	21·4 (88)
Q'	0·2 (1)	7·2 (11)	2·2 (11)	17·3 (7)	9·3 (13)	10·3 (5)	10·7 (12)	6·2 (34)	29·4 (26)
G_2	14·7 (3)	7·6 (13)	4·3 (6)	16·7 (10)	7·2 (13)	18·6 (3)	27·2 (23)	16·0 (34)	27·7 (24)
Oc. I	0·1 (1)	9·8 (8)	23·3 (6)	5·8 (6)	31·5 (12)	24·7 (3)	11·4 (10)	30·3 (20)	37·2 (15)
100 *H'*/*L*	4·4 (6)	16·3 (32)	14·5 (28)	12·7 (40)	20·7 (80)	28·1 (45)	23·7 (44)	26·2 (88)	42·7 (110)
G_1	9·1 (1)	43·3 (8)	9·0 (4)	45·0 (4)	22·7 (4)	3·0 (1)	103·0 (4)	5·9 (13)	76·7 (8)
O_1	20·5 (2)	11·6 (19)	8·0 (15)	38·2 (16)	28·7 (33)	38·7 (13)	16·9 (20)	13·0 (41)	49·4 (40)
L	9·1 (6)	28·2 (32)	51·2 (28)	14·3 (40)	46·1 (80)	31·9 (45)	20·5 (44)	51·1 (88)	43·9 (110)
100 *B*/*H'*	7·9 (6)	11·9 (32)	29·8 (28)	15·3 (40)	29·8 (80)	38·0 (45)	15·0 (44)	32·9 (88)	48·0 (110)
B	20·9 (6)	28·4 (32)	17·0 (28)	47·7 (40)	33·4 (80)	59·2 (45)	24·7 (44)	31·9 (88)	60·3 (110)
100 *B*/*L*	19·4 (6)	54·1 (32)	78·1 (28)	50·7 (40)	83·1 (80)	102·6 (45)	39·3 (44)	93·4 (88)	105·8 (110)
No. of α's	115	601	473	698	1313	700	916	1702	2026
Mean α	7·6	12·7	16·1	14·7	19·9	23·9	11·6	17·9	24·8

BLE XVI.

and Different Ranges of $\bar{n}_1$ *and* $\bar{n}_2$.

2 / *3*	*49—67* / *76—96*	*76—96* / *76—96*	*24—29* / *99—857*	*30—42* / *99—857*	*49—67* / *99—857*	*76—96* / *99—857*	*99—857* / *99—857*	No. of α's	Mean α
0)	2·5 (40)	3·4 (45)	1·7 (20)	1·1 (20)	1·3 (20)	3·4 (50)	1·5 (10)	351	2·3
0)	4·1 (80)	1·6 (45)	2·7 (24)	4·1 (48)	4·7 (64)	1·7 (80)	1·3 (28)	595	3·4
0)	3·4 (50)	3·0 (45)	9·2 (20)	8·3 (25)	3·9 (25)	16·0 (50)	16·5 (10)	406	5·1
0)	3·8 (56)	5·9 (28)	4·4 (8)	4·7 (20)	6·7 (28)	9·8 (32)	37·4 (6)	325	5·1
0)	4·7 (80)	3·2 (45)	7·9 (24)	6·3 (48)	8·7 (64)	7·4 (80)	19·6 (28)	595	6·4
0)	5·6 (56)	4·7 (28)	3·0 (8)	8·7 (20)	7·4 (28)	11·4 (32)	39·4 (6)	325	6·7
7)	4·3 (99)	8·2 (55)	4·4 (28)	10·9 (49)	5·1 (63)	9·4 (77)	16·3 (21)	703	6·9
6)	5·4 (88)	3·1 (55)	11·8 (24)	10·3 (48)	8·2 (64)	10·2 (88)	22·9 (28)	630	7·4
7)	4·5 (99)	1·9 (55)	9·9 (18)	9·8 (42)	13·7 (54)	15·0 (66)	52·8 (15)	630	7·5
6)	8·8 (55)	8·9 (55)	3·7 (15)	6·0 (30)	8·7 (25)	13·1 (55)	25·9 (10)	435	7·6
0)	7·8 (60)	2·2 (45)	5·3 (10)	7·7 (10)	11·1 (30)	14·3 (50)	29·3 (10)	300	8·1
0)	7·7 (40)	3·2 (45)	8·9 (20)	9·7 (20)	9·6 (20)	29·5 (50)	32·3 (10)	351	8·6
8)	9·7 (7)	14·3 (9)	4·7 (2)	3·9 (4)	26·2 (2)	9·7 (6)	54·3 (1)	64	9·6
0)	6·6 (80)	4·6 (45)	11·3 (32)	10·7 (56)	15·9 (64)	17·0 (80)	49·4 (28)	666	10·8
1)	15·7 (40)	15·8 (20)	17·0 (14)	10·0 (32)	16·0 (28)	20·9 (37)	35·0 (9)	339	13·4
0)	25·5 (7)	40·7 (4)	0·4 (1)	7·9 (4)	2·0 (2)	14·9 (4)	—	50	14·4
8)	15·7 (110)	21·9 (55)	7·7 (32)	13·5 (64)	15·6 (80)	20·6 (88)	31·8 (28)	820	14·8
0)	13·9 (90)	8·7 (45)	10·4 (32)	13·6 (56)	27·6 (72)	22·9 (80)	67·5 (28)	703	15·6
0)	15·0 (90)	15·8 (45)	9·0 (28)	28·6 (49)	12·3 (63)	23·0 (70)	18·5 (21)	666	16·1
0)	18·6 (48)	13·7 (22)	34·2 (14)	38·8 (34)	20·4 (39)	31·3 (44)	44·1 (15)	379	21·5
7)	21·4 (88)	10·2 (55)	29·3 (28)	18·1 (49)	34·4 (56)	28·0 (77)	91·2 (21)	666	22·8
4)	29·4 (26)	20·5 (22)	13·8 (6)	14·3 (16)	47·2 (18)	39·0 (30)	150·7 (7)	219	24·4
4)	27·7 (24)	52·4 (27)	29·2 (8)	7·3 (12)	20·8 (9)	47·2 (24)	96·3 (3)	212	26·7
0)	37·2 (15)	63·3 (10)	2·9 (4)	24·4 (8)	17·9 (6)	44·0 (10)	12·3 (1)	120	28·5
8)	42·7 (110)	66·9 (55)	6·6 (32)	23·3 (64)	25·9 (80)	65·1 (88)	39·8 (28)	820	32·6
3)	76·7 (8)	68·9 (8)	42·4 (3)	20·1 (6)	9·6 (2)	7·0 (5)	—	71	36·9
1)	49·4 (40)	30·5 (20)	51·3 (14)	28·8 (32)	63·7 (28)	90·7 (37)	123·0 (9)	339	40·5
8)	43·9 (110)	62·8 (55)	52·0 (32)	81·4 (64)	40·5 (80)	90·9 (88)	73·9 (28)	820	49·8
8)	48·0 (110)	46·2 (55)	23·3 (32)	42·8 (64)	77·6 (80)	82·2 (88)	235·4 (28)	820	49·8
8)	60·3 (110)	39·9 (55)	16·1 (32)	59·7 (64)	95·8 (80)	85·9 (88)	238·0 (28)	820	59·6
8)	105·8 (110)	120·7 (55)	45·4 (32)	146·9 (64)	161·8 (80)	184·8 (88)	370·4 (28)	820	117·1
	2026	1208	597	1122	1354	1742	493	15060	—
	24·8	23·5	16·6	29·7	34·7	40·1	82·5	—	25·9

To face p. 336

TABLE XV. *Fifteenth Table of Coefficients of Racial Likeness* ($\bar{n}_1 = 99—857$ *and* $\bar{n}_2 = 99—857$).

		Czechs (99·5)	Sicilians (106·1)	Tyrolese (129·3)	Great Russians (157·0)	Vorarlberger (315·1)	Swiss (Valais) (335·9)	Maltese (439·4)	Egyptians (26th—30th Dynasties) (857·0)
Czechs (99·5)	C.R.L. No. of Characters	— —	38·03 ± ·21 19	37·34 ± ·22 18	3·65 ± ·22 18	14·21 ± ·22 18	27·45 ± ·19 24	44·49 ± ·22 18	53·98 ± ·18 27
Sicilians (106·1)	C.R.L. No. of Characters	38·03 ± ·21 19	— —	126·15 ± ·25 13	27·32 ± ·23 16	105·00 ± ·25 13	104·91 ± ·21 20	22·33 ± ·27 11	23·42 ± ·22 17
Tyrolese (129·3)	C.R.L. No. of Characters	37·34 ± ·22 18	126·15 ± ·25 13	— —	61·80 ± ·24 14	34·58 ± ·21 20	25·23 ± ·23 16	118·81 ± ·22 17	150·98 ± ·21 20
Great Russians (157·0)	C.R.L. No. of Characters	3·65 ± ·22 18	27·32 ± ·23 16	61·80 ± ·24 14	— —	27·97 ± ·24 14	48·51 ± ·22 18	50·26 ± ·25 13	62·87 ± ·22 18
Vorarlberger (315·1)	C.R.L. No. of Characters	14·21 ± ·22 18	105·00 ± ·25 13	34·58 ± ·21 20	27·97 ± ·24 14	— —	20·23 ± ·23 16	190·30 ± ·22 17	259·89 ± ·21 20
Swiss (Valais) (335·9)	C.R.L. No. of Characters	27·45 ± ·19 24	104·91 ± ·21 20	25·23 ± ·23 16	48·51 ± ·22 18	20·23 ± ·23 16	— —	205·29 ± ·23 16	272·26 ± ·20 22
Maltese (439·4)	C.R.L. No. of Characters	44·49 ± ·22 18	22·33 ± ·27 11	118·81 ± ·22 17	50·26 ± ·25 13	190·30 ± ·22 17	205·29 ± ·23 16	— —	63·76 ± ·21 20
Egyptians (26th—30th Dynasties) (857·0)	C.R.L. No. of Characters	53·98 ± ·18 27	23·42 ± ·22 17	150·98 ± ·21 20	62·87 ± ·22 18	259·89 ± ·21 20	272·26 ± ·20 22	63·76 ± ·21 20	— —

and it shows that there are surprising differences between the measurements in that respect. The lower six characters are seen to have a greater average effect on the coefficient than have the remaining 25 together, and the cephalic index is nearly twice as influential as any other character*. No sharp division is made between measurements of the calvaria and of the face, or between absolute, indicial and angular measurements, or between arcs and chords. But the value of the coefficient is, in fact, determined almost entirely, in the majority of cases, by differences between the calvarial lengths, breadths and heights and between the three resulting indices. They are the dominant factors which have been controlling the generalised criterion of racial resemblance used†.

Having gained some conception of the relative worth of the individual measurements in indicating real, as distinct from chance, differences between the racial series, it will now be of interest to consider them one by one. The inter-racial "group-means" for 13 of the most constant characters (i.e. the ones showing the smallest mean values of α in Table XVI) are given in Table XVII, and with them are the data for three others—$B\angle$, GL and GB—not used in computing the coefficients. It is not to be expected that any of these characters will be of service in either confirming, or weakening, the classification suggested, or any other classification. Several of the greatest differences between the means for the groups are found to be extraordinarily small, five being less than 1 mm. and one less than a degree. The total range of the racial means of the foraminal indices is only from 82·9 to 86·9 and there are only 14 differences which are definitely significant—$\alpha > 10$, say—in 351 comparisons: eight are with the Serbo-Croats ($100\,fmb/fml = 86{\cdot}9$) and the other six with the Würtemberger (86·4). The components of the index are rather less constant on the average, but that is largely due to the extremely small values given for the aberrant Sicilian series. Its *fml* is 33·5, the next greatest mean being 35·15, while the greatest of all is only 37·6. The Sicilian *fmb* is 27·9 and the other series range from 29·5 to 31·8. All the greatest values of α for the foraminal absolute measurements are occasioned by these small Sicilian means. The nasal index ($100NB/NH'$) is hardly more variable than the foraminal. It is curious that the three lowest means found are for members of the *C* group (viz. for the Basques (44·8), French (45·8), and Pompeians (46·0)), but without the confirmation of more adequate material it would be rash to affirm that a low nasal index is a characteristic of that group. The inter-racial means of the other three are almost identical. The greatest nasal index is found for the Predynastic Egyptians (50·0) and that has been supposed due to slight Negroid admixture‡. The closely allied Sardinians (48·6) are nearer to the European average in that respect. The nasal breadth (*NB*) ranges from 23·1 to 25·5 and the two lowest means are for the French (23·1) and Basques

* For several of the comparisons made, the value of α for $100\,B/L$ exceeds the sum of all the other α's.

† At the same time it must not be forgotten that the three major chords of the calvaria have intra-racial correlations with one another of the order ·25 while an index and one of its component lengths may have a correlation as high as ·7. The orbital and palatal measurements are particularly liable to errors of personal equation and they may have higher mean values of α than the other facial measurements on that account.

‡ See *Biometrika*, Vol. XVII. 1925, p. 8.

(23·2) of the *C* group. The nasal height of the Sicilians (49·2) is extreme, but means only slightly greater are given for Great Russians (49·6) and Slovenes (49·7). The Copts (*C* group) have the greatest *NH'* (53·8), the Tyrolese (*B*) the next (53·0), and the Reihengräber (*D*) the next greatest. No group is characterised by a peculiarly large nasal height, but the *A* may possibly be distinguished by having a larger proportion of series with smaller means than the European average. The upper facial height (*G'H*) must be highly correlated inter-racially with *NH'*, but it does not confirm the relation suggested by the latter. In spite of its less characteristic mean, however, the smallest values of *G'H* are again for members of the *A* group, viz., for the Czechs (67·3) and Rumanians (67·9), and these two are very significantly smaller than the upper extreme given by the Tyrolese (74·5). But the last is an

TABLE XVII.

"Group-Means" for the most Constant Characters.*

Character	"Group-Means"				Greatest differences between "Group-Means"
	A	*B*	*C*	*D*	
100 *fmb*/*fml*	84·60 (6)	84·84 (5)	85·25 (4)	84·13 (3)	1·12
fml	35·89 (6)	36·28 (5)	36·20 (5)	36·48 (4)	0·59
fmb	30·37 (6)	30·71 (5)	30·91 (4)	30·30 (3)	0·61
100 *NB*/*NH'*	47·60 (5)	47·86 (8)	46·23 (6)	47·69 (9)	1·63
NH'	50·52 (5)	51·06 (9)	51·63 (6)	51·13 (8)	1·11
NB	24·02 (5)	24·39 (8)	23·85 (6)	24·30 (9)	0·54
N ∠	64°·02 (6)	66°·13 (3)	63°·95 (4)	64°·98 (5)	2°·18
A ∠	73°·88 (6)	71°·87 (3)	73°·68 (4)	73°·56 (5)	2°·01
B ∠	42°·10 (6)	41°·97 (3)	42°·38 (4)	41°·43 (5)	0°·95
G'H	70·00 (6)	71·24 (9)	70·12 (6)	69·56 (9)	1·68
GL	94·46 (7)	96·43 (3)	93·40 (4)	95·98 (6)	3·03
LB	100·36 (7)	99·52 (9)	99·65 (6)	101·97 (9)	2·45
100 *G'H*/*GB*	74·65 (6)	76·23 (6)	73·63 (4)	73·89 (8)	2·60
GB	93·83 (6)	94·08 (6)	94·14 (5)	94·05 (6)	0·31
C	1459·9 (7)	1516·2 (4)	1484·2 (4)	1477·3 (5)	56·3
O_2	33·27 (7)	33·76 (9)	33·47 (6)	33·25 (8)	0·51

outlying value as the next greatest *G'H* is 71·9 for the Turks. The material available is not sufficient to establish any definite differences between the groups for these measurements. The profile length *GL* from basion to alveolar point is not used in computing the coefficients, and no measure has been obtained which will indicate the significance of its differences. There can be no doubt, however, that the extreme values—the Basques (90·7) and Czechs (92·3) at one end, and the Swiss (Sierre) (97·6) and Reihengräber (98·0) at the other—would show quite high values of α. The material is not extensive enough to establish any clear differences between the means for the various groups. As in the case of *GL* the basal length *LB* from nasion to basion does not appear to be highly correlated inter-racially with the glabella-occipital length *L* (cf. Tables XVII and XVIII). The *D* group has the greatest

* All the means of the series used in making up this table are based on 30 or more skulls.

mean *LB* and that probably exceeds the other three by a significant amount; but the smallest serial mean for the *D* group (Farringdon St. English = 100·1) is less than the greatest in any one of the other groups. The nasal ($N\angle$), alveolar ($A\angle$), and basal ($B\angle$) angles are those of the triangle having the three preceding chords (*G'H*, *GL* and *LB*) for its sides. The basal angle appears to be remarkably constant for European types, the means only ranging from 40°·4 to 43°·0; and the numbers of series available are not sufficient to indicate any very positive differences between the groups in the case of the other two angles. But the three alveolar angles for members of the *B* group are actually the three smallest recorded, and the nasal angles for the same series are all greater than the four values given for members of the *C* group. If these distinctions are confirmed by additional material, they may prove of service in aiding the discrimination of racial types. Outstanding values of the angles of the fundamental triangle are the small $N\angle$'s for the Basques (61°·9) and Serbo-Croats (62°·4) and the large $A\angle$'s (75°·0 and 75°·6 respectively) for the same two series. It is particularly interesting to find that the "group-means" for the bi-maxillary breadth *GB* are practically identical, since the bi-zygomatic *J* and calvarial breadths *B'* and *B* show marked differences (Table XVIII). The types with the smallest means are the Basques (90·1), Whitechapel English (90·9) and Farringdon St. English (91·4) and their juxtaposition is suggestive, but the Guanche have been supposed closely allied to these three (see Fig. 2) and the greatest *GB* (99·9) is theirs. The upper facial index (100 *G'H*/*GB*) appears to be appreciably greater for the *B* than for the other groups, the difference being dependent on *G'H* rather than on *GB*. The measurements of the capacity *C* are of doubtful value, since different methods of technique were used to determine them, but the comparison of the calvarial lengths, breadths and heights renders it extremely probable that the observed difference between the mean capacities of the *A* and *B* groups is a real one. The smallest *C*'s recorded are for the Predynastic Egyptians (1389 cms.) and Sicilians (1395 cms.). The orbital height O_2 is as little able to differentiate the groups as any other of these measurements. The Sicilians have the smallest mean (31·6) and the Tyrolese the greatest (36·0), the latter being an outstanding value as the next greatest O_2 is 34·7 for the Turks. All the greatest values of α were found with one or other of these extremes.

As was anticipated from the mean values of α (Table XVI), the direct comparison of these 16 characters has led to no definite confirmation or refutation of the classification suggested by the coefficients. An ideal distinction between the four groups would be made if their inter-racial distributions for a particular character did not overlap at all. Nothing approaching that condition has as yet been found. The only inter-racial distribution for a group which does not overlap one or more of the distributions for the other three groups is that provided by the three (!) $A\angle$'s of the *B* group. The small number of series, and the fact that few of the differences in the case of that character are definitely significant, make that a questionable relation, however. The three $N\angle$'s of the *B* group series are all greater than the four of the *C*, but apart from these two cases it has been found that every inter-racial distribution for these characters overlaps

every other one. The "group-means" may still be significantly different and the following relations have been suggested by comparing them, though all have need to be confirmed by more adequate material:

(*a*) The *C* group type is characterised by a low nasal index.

(*b*) The *A* group type may be characterised by a small nasal height, but its upper facial height is not distinctive.

(*c*) The *B* group type is characterised by a large nasal and a small alveolar angle, and by a large upper facial height and upper facial index.

(*d*) The *D* group type is characterised by a large nasio-basal length.

(*e*) The *B* group type has a larger capacity than the *A* group type.

No combination of these measurements seems to provide a more useful guide to racial differentiation than they do when considered singly.

A comparison of the remaining characters is likely to be far more profitable. Unfortunately the value of the data available for several of them is greatly diminished by the fact that different methods have been used to measure the same morphological character, so that direct comparison cannot be made between all the means. The profile angle ($P\angle$) has been defined in two ways: the first measures the angle between the line joining nasion to prosthion and the Frankfurt horizontal plane, and the second the angle between the line joining nasion to alveolar point and the same plane. In the case of a particular skull the second will exceed the first by one or two degrees. Most means are available for series belonging to the *D* group; they are:

Prosthion $P\angle$: Reihengräber 84°·6, Swedish Prehistoric 84°·8.

Alveolar $P\angle$: English (Farringdon St.) 85°·9, English (Whitechapel) 86°·1, Egyptians (26th—30th Dyns.) 85°·8.

The differences between the comparable pairs are quite insignificant. For the *C* group the prosthion $P\angle$'s are Copts 85°·4 and French 86°·5, and the Guanche have an alveolar $P\angle$ of 86°·8. These means accord excellently with one another and with the previous values. The prosthion $P\angle$'s of 85°·0 for the Badensians and 86°·4 for the Würtemberger are of precisely the same order, but a startling difference is found in the Bavarian (Altbayerisch) mean of 89°·1. The alveolar $P\angle$ of 88°·3 for the Czechs is not so extreme, but it differs markedly from the other means. The only significant values of α are given by comparisons with these two outlying observations, and some confirmation of their correctness would be welcome.

The orbital width has shown more significant differences than any other facial measurement (see Table XVI) but inter-racial comparison is again hampered by the fact that it has been measured in different ways (see Appendix II). In the case of any particular skull "border" O_1 > dacryal O_1' > Schmidt's lacrymal O_1. For the Frankfurt width O_1 and the resulting index 100 O_2/O_1 the means are:

A Group: Slovenes $O_1 = 39{\cdot}2$ (100 $O_2/O_1 = 83{\cdot}8$).

B Group: Vorarlberger 39·2 (85·2), Würtemberger 39·8 (85·9), Bavarians (Altbayerisch) 39·9 (84·5), Bavarians (Waischenfeld) 41·6 (82·7), Tyrolese 41·9 (86·1).

C Group: French 38·2 (87·3), Basques 41·2 (81·9).

D Group: Swedish Prehistoric 40·2 (80·3), Egyptians (26th—30th Dyns.) 41·1 (82·2), Reihengräber 41·5 (78·3), English (Farringdon St.) 42·3 (81·0), English (Whitechapel) 43·0 (77·7).

E Group: Predynastic Egyptians 41·6 (77·4).

Comparison can only be fairly made between the *B* and *D* groups. Members of the latter show a slight tendency to have the greater orbital widths and all the indices are lower for the *D* group than for the *B*. But the most extreme differences are found with the French O_1. The following means can be given for dacryal measurements:

A Group: Turks $O_1' = 38{\cdot}7$ (100 $O_2/O_1' = 89{\cdot}7$), Czechs 38·8 (84·2), Rumanians 38·9 (82·0), Greeks 39·3 (87·3), Serbo-Croats 39·7 (84·1).

B Group: Swiss (Sierre) 36·5 (89·0), Swiss (Valais) 36·8 (89·1).

C Group: Basques 39·1 (86·3), Pompeians 39·8 (85·2), Guanche 39·8 (82·6).

D Group: English (Farringdon St.) 39·8 (85·9), English (Whitechapel) 40·5 (82·5).

E Group: Predynastic Egyptians 39·1 (82·4).

Sicilians 36·5 (86·7).

The distinction between the *B* and *D* groups is confirmed by these means, but no difference can be found between the *A* and *C* groups. The only markedly significant values of α for O_1' are given by comparisons between the extremely small means for the two Swiss series and the Sicilians, on the one hand, and the 11 other series, on the other. Only one mean of Schmidt's lacrymal O_1 can be given for each of the *A*, *B*, *C* and *D* groups. They are practically identical, being, respectively: Great Russians 38·85 (100 O_2/Schmidt's $O_1 = 83{\cdot}7$), Badensians 38·7 (87·9), Etruscans 38·6 (85·2) and Bohemians (Mediaeval) 38·8 (83·7). But again the index for the last series, of the *D* group, is significantly less than that for the Badensians of the *B*. The evidence of the orbital width and index has not proved to be particularly suggestive. The fact that the former has shown a peculiarly high mean value of α is seen to depend less on the differences being usually greatly significant than on the fact that four of the series—viz. the two Swiss, French and Sicilians—have outstandingly low means. Series belonging to the *D* group appear to have greater orbital widths on the average than those of the *B*, and all the orbital indices of the former are lower than the orbital indices of the latter group. The available evidence suggests no other differences between the groups for these characters.

Judging from their high mean values of α (Table XVI), the palatal length (G_1) and breadth (G_2), and to a lesser extent the palatal index, are all characters which vary greatly from type to type. But they are of little use for our present purpose

since the measurements have been determined in a variety of different ways. The *Frankfurt Verständigung* breadth G_2, taken between the inner alveolar walls of the second molars, has been given for the following 15 series:

A Group: Slovenes 38·1, Czechs 40·9.

B Group: Bavarians (Altbayerisch) 33·2, Badensians 35·4, Würtemberger 38·1.

C Group: French 37·2, Copts 39·1, Etruscans 40·8, Guanche 41·7.

D Group: Maltese 36·2, Egyptians (26th—30th Dyns.) 38·8, English (Farringdon St.) 39·3, English (Whitechapel) 39·6, Reihengräber 39·8.

E Group: Predynastic Egyptians 40·7.

All the most extreme differences are seen to be those occasioned by the peculiarly small Altbayerisch mean. Ranke provided another palatal breadth for the same skulls taken, "an den beiden hinteren Endpunkten des Gaumens resp. der inneren Alveolarränder gemessen" (6*, p. 151) and the mean given is 37·3 (61). That exceeds the Frankfurt measurement by 4·1 mm. and, if that difference is correct, the inner alveolar walls of the right and left molar regions must be less parallel for those Bavarian skulls than for most racial types. The next smallest G_2 is for the Badensians and that is very significantly less than the Würtemberger value. It is surprising to find such a great difference between the two as, apart from palatal measurements, the types are almost identical (see Table I). Weisbach's "Gaumenbreite" was taken, "zwischen den inneren Lamellen des Zahnfächerfortsatzes am hinteren Ende," and the means of 38·4 for Rumanians and 39·4 for Turks appear to be quite normal. Tarenetzky's is defined to be, "die Entfernung zwischen der medialen Wand des Alveolarfortsatzes, entsprechend dem Zwischenraum zwischen dem 2ten und 3ten hinteren Backenzahn," and this vaguely defined measurement cannot be compared with any other palatal breadth. The mean given for Great Russians is 37·9. Broca's palatal breadth is, "le maximum d'écartement de la courbe intérieure de l'arcade alvéolaire," and that will be but slightly greater than the Frankfurt G_2. The mean of 38·5 for the Swedish Prehistoric is thus not extreme: those for the two Swiss series—Valais 37·4, Sierre 36·5—are decidedly small. This very imperfect evidence suggests that nearly all the series belonging to the *B* group have appreciably narrower palates than the others considered. No clear distinction is made, however, between the other three groups.

The palatal lengths are even more unsatisfactory. The *Frankfurt Verständigung* definition is: "Gaumenlänge: von der Spitze der Spina des harten Gaumens, Spina nasalis posterior, bis zur inneren Lamelle des Alveolarrandes zwischen den mittleren Schneidezähnen." The following means and resulting indices have been given by those who have followed that definition *without commenting* on the fact that the anterior terminal is insufficiently defined:

A Group: Slovenes $G_1 = 45·7$ ($100\ G_2/G_1 = 83·4$), Great Russians 45·0.

B Group: Badensians 41·9 (84·8), Würtemberger 51·7 (74·2).

C Group: French 46·6 (80·1).

* This number refers to the reference given in Appendix I. The measurements are defined more exactly in Appendix II.

There is again an alarming difference between the Badensians and Würtemberger and it seems to be extremely probable that the palatal length and breadth of these two series were measured in different ways. The only way to decide that point would be to re-measure them. There is a fair agreement between the other palatal lengths. Weisbach's measurement: "Gaumenlänge in der Mittellinie ohne die hintere Spina," will not be comparable with the others, but the means for Rumanians (46·1) and Turks (45·2) are of the same order as the previous ones. Schmidt also took the palatal length from the base of the posterior nasal spine, but he defined the anterior terminal more adequately as the point of intersection of the common tangent to the hinder alveolar margins of the two middle incisors and the median plane (G_1'). The following means can be given:

C Group: Etruscans $G_1' = 45{\cdot}5$ (100 $G_2/G_1' = 89{\cdot}2$), Copts 46·4 (84·6).

D Group: English (Whitechapel) 44·7 (88·6), English (Farringdon St.) 46·0 (85·4), Egyptians (26th—30th Dyns.) 46·3 (83·9).

E Group: Predynastic Egyptians 48·0 (84·8).

No distinction is made between the *C* and *D* groups. Broca's palatal length is measured from the inner alveolar wall between the middle incisors to the tip of the posterior nasal spine, so it will be greater than G_1' in the case of a particular skull. The means available are: Swiss (Sierre) 54·3 (Broca's palatal index = 67·2), Swiss (Valais) 54·5 (68·7) and Swedish Prehistoric 52·1 (73·6). Yet another palatal length is furnished by the followers of von Luschan's methods. It is measured, "parallel mit der Mittellinie, von der Mitte des hinteren Alveolarrandes eines ersten Schneidezahnes, bis zum Rande der Ausbuchtung neben dem hinteren unteren Nasenstachel," and that will be almost exactly equal to G_1'. The means available are for the Czechs 44·0 (100 G_2/v. Luschan's $G_1 = 93{\cdot}0$) and Guanche 45·1 (92·5). The most significant differences between palatal lengths are seen to be those occasioned by the small Badensian and large Würtemberger means, and they are for members of the same group. The Würtemberger palatal index is the most outstanding value on account of its lowness. Some verification of these results is clearly needed.

The comparison of all the mean facial measurements, with the exception of *J*, for the 41 series has now been completed and it must be admitted that it has failed to provide any definite confirmation of the racial classification adopted, or to suggest any other classification. The measurements of the orbits and palate which appear to be most capable of distinguishing the racial types are unfortunately the ones for which the data available are most unsatisfactory. The following relations have been fairly well established, however:

(*a*) The series belonging to the *D* group tend to have greater orbital widths than those of the *B*, and all the available orbital indices of the latter are greater than those of the former. But neither is distinguished from the *A* and *C* groups by those characters.

(*b*) The series belonging to the *B* group are often distinguished by having narrower palates.

(*c*) The previous relations found between facial measurements (summarised on p. 341) are less well established than the above two.

(*d*) The material is perhaps adequate enough to warrant the prognostication that, even with far more extensive material, the facial measurements of the skull will not be of great use as criteria which will differentiate European races. Some of them are remarkably constant, and others may have distinctive inter-racial means for one or more of the families of races, but no facial character usually measured is likely to make a trenchant division between them.

Two of the series are characterised by the peculiar sizes of their facial skeletons. The Tyrolese have the greatest means for $G'H$, NB and O_2; for NH' they are the 2nd greatest of 31, for GB the 3rd greatest of 24, for O_1 the 3rd greatest of 13, and for J the 4th greatest of 33. The absolute calvarial measurements, and the facial and calvarial indices, of that series are not in any way peculiar, and the fact that it has not shown a close approach to any other series (see Fig. 4) is clearly to be attributed to the outstanding size of its facial chords. The Sicilians could not be placed in any of the groups distinguished, and their discordance is largely due to the opposite condition. Their means are the smallest recorded in the case of NH', O_2 and O_1'; the J is the 2nd smallest of 33, the NB the 4th smallest of 31, and the $G'H$ the 6th smallest of 32. The Sicilian GL, however, is rather greater than the inter-racial mean. Some explanation or confirmation of these discordances would be welcome; it is possible that they may have arisen as the result of inaccurate sexing.

If any single characters, or combinations of two or three characters, can serve by themselves to make a clear distinction between the various families of European races, then we may expect to find them among the calvarial measurements which have not, as yet, been considered. These include three breadths—the bizygomatic J, the least frontal B' and the greatest calvarial B. The first two have shown moderately high values of $\bar{a}$ (Table XVI) and the third has more significant differences on the average than any other absolute measurement. The "group-means" for the three characters are given in Table XVIII. In each case the greatest is for the B group and the second greatest, for B and J, are for the A group. The smallest inter-racial mean is shown by the C group in the cases of J and B', but by the D group in the case of the calvarial breadth. The differences between the means of the series in the same group, however, are quite considerable and for J and B' every inter-racial distribution overlaps every other one. That is not so for the calvarial breadth. In the case of that character the smallest mean for a series in the B group just exceeds the greatest mean for an A group series (see Fig. 7), and there is a wide gap between the B group on the one hand and the C and D groups on the other. The A, C and D groups have overlapping distributions. The proportions of the three breadth measurements to one another do not provide indices which are of any value for our present purpose. It may be noticed that the Predynastic Egyptians, Sardinians and Sicilians have means for J, B' and B which are very decidedly smaller than any others, and the discordance of these series is evidently due

primarily to that fact. The basio-bregmatic height H' is not one of the most variable characters, and it is therefore not surprising to find that all its inter-racial distributions for the groups overlap one another. Very significant differences are found, indeed, between pairs of series belonging to the same group; for the D group the mean H''s range from 129·7 to 138·0, while the total range for all series is only from 128·9 to 138·0. But no grouping based on the heights alone is of any suggestiveness. The only mean H''s less than 130 are for such racially diverse series as the Bavarians (Waischenfeld), Würtemberger, Copts, French and English (Farringdon St.). The index 100 B/H' ("group-means" are shown in Table XVIII and individual means in Fig. 8) again makes an absolute distinction between

TABLE XVIII.

"Group-Means" for the most Variable Characters.*

Character	"Group-Means"				Greatest differences between "Group-Means"
	A	*B*	*C*	*D*	
J	132·86 (7)	135·06 (9)	130·76 (5)	130·93 (10)	4·30
B'	97·06 (8)	99·90 (8)	96·60 (6)	97·44 (11)	3·30
B	144·97 (9)	149·20 (10)	142·98 (6)	140·45 (11)	8·75
H'	133·80 (8)	131·41 (9)	130·88 (6)	134·22 (9)	3·34
L	176·19 (9)	180·38 (10)	183·18 (6)	187·85 (11)	11·66
100 B/L	82·33 (9)	82·70 (10)	78·10 (6)	74·77 (11)	7·93
100 H'/L	76·16 (8)	73·03 (9)	71·48 (6)	71·79 (8)	4·68
100 B/H'	108·09 (8)	113·48 (9)	109·30 (6)	104·99 (9)	8·49
S	363·6 (9)	368·4 (8)	369·7 (6)	379·8 (9)	16·2
S_1	126·48 (8)	128·67 (6)	126·86 (5)	128·68 (4)	2·20
S_2	125·21 (9)	124·76 (5)	124·76 (5)	128·93 (4)	4·17
S_3	111·44 (8)	116·54 (5)	117·18 (5)	119·85 (4)	8·41
S_3'	94·30 (6)	—	98·23 (4)	97·60 (4)	3·93
100 S_1/S_2	100·96 (8)	103·34 (5)	101·70 (5)	99·80 (4)	3·54
Oc. I	62·38 (6)	—	59·40 (4)	59·30 (4)	3·08
U	511·0 (2)	526·0 (8)	522·3 (5)	528·9 (8)	17·9
Gb. U	512·6 (5)	—	513·2 (1)	526·1 (2)	13·5
Q'†	327·7 (6)	327·2 (7)	313·3 (5)	312·1 (6)	15·6

the B and the other three groups, which are not distinguished from one another except by their mean values‡. The glabella-occipital length L has influenced the coefficients almost as much as the calvarial breadth B. All the differences between the "group-means" are clearly significant. The series in the A group have smaller L's than those in the C and D groups, but, otherwise, the distributions overlap (Fig. 7). The Maltese length is distinctly removed from all others for series in the same D group and, if it be excluded, there is a sharp division between the B and D groups. The cephalic index 100 B/L has a pre-eminently high

* All the means of the series used in making up this table are based on 30 or more skulls.

† Several adjusted means were used to give the "group-means" of Q'. See Appendix II.

‡ The distinctions made between the groups by the indices 100 J/H' and 100 B'/H' are almost as sharp as for 100 B/H'.

value of $\bar{\alpha}$ (Table XVI). From Fig. 7 it will be seen that this is due to the fact that its two components, which are both highly variable, are negatively correlated inter-racially when all the European series are considered together*. Absolute divisions are made between the *D* and the other three groups, and between the *C* and the other three groups. The inter-racial distributions for the *A* and *B* groups have almost identical means and ranges, so this most promising character is quite incapable of making all the distinctions which have been established by other means. It is, however, the only character which makes a division between more than one of the four groups and all the others. The index $100\ H'/L$ divides all the *A* group series with their higher values from all members of the *C* group, but the other pairs of inter-racial distributions overlap. The "group-means" of the *A* and *B* classes differ very appreciably, however, and the smallest mean for a series in the former group (Great Russians = 74·6) is almost identical with the greatest for a series in the latter (Swiss (Valais) = 74·8).

It is extremely probable that there is no single measurement of the skull, whether absolute, indicial or angular, which is capable of making sharp divisions between the various families of European races, and the evidence afforded by measurements considered singly is hence of little value. Some pairs of measurements taken in conjunction do appear to serve that purpose, however. When points representing the series are plotted with rectangular co-ordinates—the scale of the one measurement being along the abscissa and of the other along the ordinate—then it is found that for some pairs of characters the points belonging to a particular group which have been previously differentiated by the more general method are divided off from the areas representing their own groups. It may be confidently asserted that, out of all the characters dealt with, the only pairs which are at all capable of serving that purpose are to be found among those showing the highest mean values of α. And it is probable that the number from which they can be drawn is still further restricted to the calvarial length, breadth and height and the three indices derived from those absolute measurements. The two most suggestive arrangements are shown in Figs. 7 and 8 and the length is used in both. It is clear that these diagrams would not of themselves have suggested a grouping of the series precisely the same as the one adopted. Indeed, the two figures might have suggested two different arrangements. It is evident, too, that the complex inter-relations of the series cannot possibly be represented on a two-dimensional diagram of this kind; but Fig. 7 does show that a two-character comparison is likely to lead to a more satisfactory grouping than a single character one, e.g. using cephalic index alone. It indicates the need for still further increasing the number of characters employed. Neither should it be forgotten that the probable errors of some of the means are of the same order as some of the smaller inter-racial differences. The limitations to the conclusions which can be claimed from any pair of measurements considered together are sufficiently obvious,

* It is curious, however, that there is not the slightest suggestion of a negative inter-racial correlation between *B* and *L* for any of the groups of series considered separately. The numbers of series in the several groups are so small that it is best to ignore that suggestion at present.

but such comparisons may confirm and strengthen a classification which has been based on other, and more reliable, evidence. Figs. 7 and 8 may be supposed to lend material support to the arrangement given in Fig. 2; the *C* group series in all three occupies a central position with the other groups ranged round it, so that the *A* and *B* are closer to one another than either is to the *D* group. But it is clear that no pair of characters can give any conception of the inter-relations of the series within the

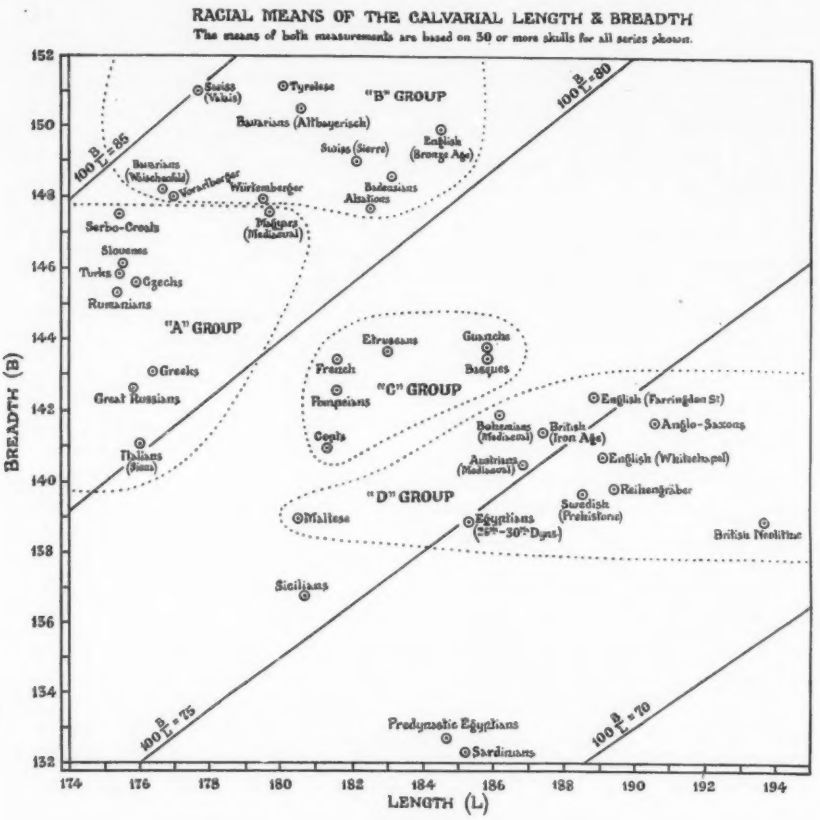


Fig. 7.

groups similar to arrangements shown in Figs. 3—6. The arrangements of the series within any particular group are, indeed, essentially different in Figs. 7 and 8. On both these diagrams, but more particularly on Fig. 8, the compactness of the *A*, *B* and *C* groups is contrasted with the diffuseness of the *D*, and that again suggests that it may be necessary to divide the last into two groups. But the evidence of additional material would alone justify such a procedure.

The only other measurements used in computing the coefficients which have not been considered are the major calvarial arcs (S, U and Q') and the occipital index ($Oc.\ I$). Each arc is associated by "mathematical necessity" with one pair or another of the three major chords L, B and H'. The average differences of the arcs are of the same order, when expressed in terms of the intra-racial standard deviations (see Table XVI), and they each affect the coefficients rather more than

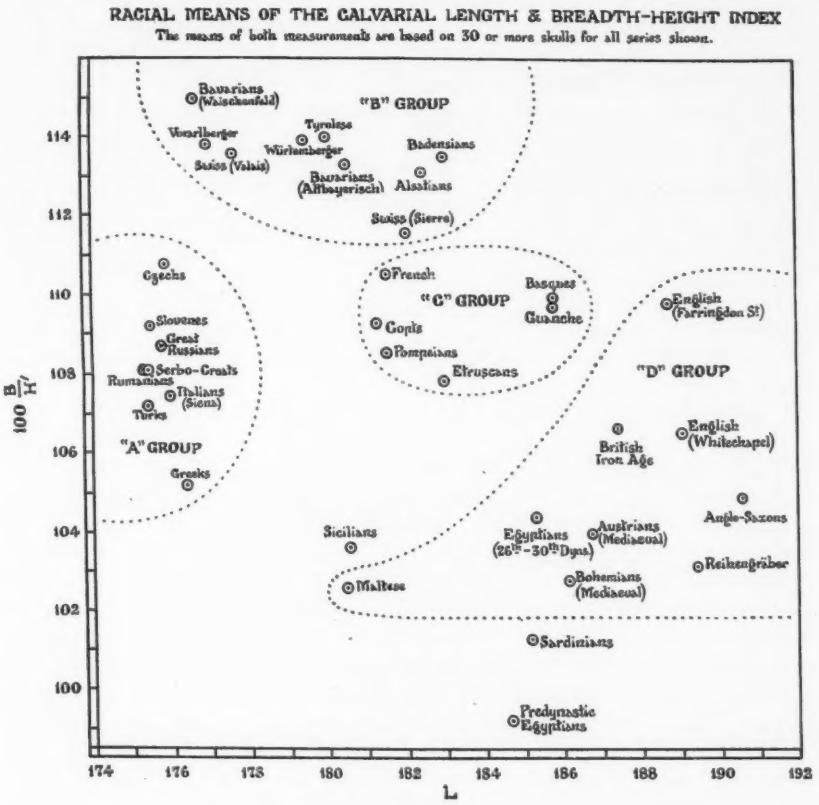


Fig. 8.

H' does, but very appreciably less than either L or B. The "group-means" for the arc from nasion to opisthion S are given in Table XVIII and they arrange the groups in the same order as L does. But for S the A and D inter-racial distributions are the only ones which do not overlap. The component arcs of S—from nasion to bregma S_1, bregma to lambda S_2 and lambda to opisthion S_3—are not used in computing the coefficients, but a comparison of their means will be of interest. The occipital arc is the only one which seems to be highly correlated inter-racially with

either *S* or *L*. The *A* group series are characterised by having extremely small values, and their greatest mean (Greeks = 112·6) is 2·6 mms. less than the smallest recorded for the series in the other groups. The chord from lambda to opisthion S_3' makes the same absolute distinction between the *A* and *D* groups, but not between the *A* and *C* groups. No means of that character are available for series belonging to the *B* group. The greatest mean S_2 for a series in the *C* group is less than the least for a *D* group series, but otherwise the inter-racial distributions overlap and all four overlap one another in the case of S_1. The proportions of the three components to the total arc from nasion to opisthion are not suggestive, but a clear distinction is made between the *B* and *D* groups by the index $100\,S_1/S_2$. Nothing certain can be inferred from the occipital indices *Oc. I*, as at present so few means are available, but, on the average, they seem to be appreciably higher for the series in the *A* group than for those in the *C* and *D*. The horizontal circumference of the calvaria has, unfortunately, been measured in two different ways: the first *U* passes over the ophryon and the second *Gb. U* over the glabella. For a particular skull the second circumference may exceed the first by several mms. For this character there is again a sharp distinction made between the *A* and the other three groups when "group-means" are compared (Table XVIII), but the *A* and *B* and *A* and *D* groups are the only pairs of inter-racial distributions which do not overlap. Comparison of the values of the transverse circumference *Q'* is rendered uncertain by the fact that four different ways of measuring that character have been employed. It has been assumed that the average differences between them will be the same for all types, so they could all be reduced to give the "group-means" in Table XVIII. The *A* and *B* groups are now contrasted with the *C* and *D* groups, but, in spite of the large differences between their mean values, the only inter-racial distributions which do not overlap are those for the *B* and *C* groups. The comparison of single measurements is now completed.

(7) *Conclusions.* It is suggested that the method of Professor Karl Pearson's Coefficient of Racial Likeness has provided a means of classifying European races which is far more correct in theory, and effective in practice, than any other that has hitherto been used. But the material dealt with in the present paper is not extensive enough to warrant any but tentative conclusions. As has been usually supposed, the various racial types represented were found to have very complex inter-relations. It has been possible to divide 38 of the 41 series into four distinct groups such that, in general, all the series in any one are more closely related to one another than they are to the series in the other groups. The connections of the groups are shown in Fig. 2 (p. 329) and the inter-relations of the series within the groups in Figs. 3—6 (pp. 330—333). These diagrams were constructed solely on the evidence afforded by the coefficients, and the question whether, and to what extent, they may be taken to indicate true blood-relationship has now to be considered. The first, or *A*, group comprises the Serbo-Croats, Turks, Greeks, Mediaeval and Modern Magyars, Slovenes, Rumanians, Czechs, Great Russians and Italians (Siena). The population from which these ten samples were drawn is located to-day in Eastern Europe. The first six have remarkably close inter-

relations, and they are confined to the extreme south-eastern corner of the continent. All the series from that area are included in the group. The other four series form, as it were, a branch of that main stem (see Fig. 3) with the Rumanians and Czechs closest to it, while the Great Russians project beyond those two and the Italians (Siena) beyond the Great Russians. The last four series all have peripheral geographical positions with regard to the others, but the close association of Italians and Russians is, of course, quite unexpected. There is no clear evidence to suggest that the divergence of these two and of the Rumanians and Czechs from that more stable type, of which the other six series are variants, is in any way due to admixture with other European types. A sharp line of division can be drawn between these *A* group series and all others. It is interesting to note that the physical classification is entirely unconnected with that suggested by language.

The *B* group comprises two Swiss series, Alsatians, Badensians, Würtemberger, Bavarians (Altbayerisch), Vorarlberger, Bavarians (Waischenfeld), Tyrolese and the English Bronze Age series. The last three are but loosely connected with the others, but the first seven have numerous close inter-connections (Fig. 4). Apart from the English Bronze Age type, which is probably extinct to-day, the others are all of mediaeval or modern date, and they are again found to occupy a restricted geographical area which is coterminous to the east with the one occupied by the *A* group series. But, from the evidence of the coefficients, there has not been the slightest difficulty in deciding whether a series should be assigned to the one group or to the other.

The *C* group is less homogeneous and unique than either of the two previous ones. Its nucleus is represented by Etruscans and Pompeians (Fig. 5). Both Basques and Guanche are closely connected with these two, but not with one another, while a French series of somewhat uncertain origin, and a series of Coptic skulls, have their closest bonds with the Pompeians and no other very intimate ones. Geographically the six populations represented are scattered over a very wide area, though the Etruscans and Pompeians again occupy a central position. Several of the relations observed are not ones which would have been anticipated, and a comparison with intermediate types will be needed to elucidate this somewhat anomalous state of affairs. These six series appear to be definitely bound to one another more closely than they are to any of the series in the other groups, but the Etruscans, French and Pompeians have some fairly close connections with some of the series in both the *A* and *B* groups (see Fig. 2). The Copts, Guanche and Basques have no such connections however.

There are 12 series which are supposed to make up the fourth (*D*) group. Five of them—the English (Whitechapel), British Iron Age, Anglo-Saxons, Reihengräber and Mediaeval Austrians—form a nucleus, every one being intimately connected with every other one. The English (Farringdon St.) and British Neolithic have each two close connections with different pairs of these five series (Fig. 6) and the Swedish Prehistoric series has close connections with three of the same five. These eight represent Western Europe from Neolithic to modern times

and part of Central Europe in mediaeval times. It is surprising to find that the late Dynastic Egyptians also have three close connections with the five series which form the nucleus of the group. A Spanish Bronze Age series, and one of Mediaeval Bohemians, resemble closely the Mediaeval Austrians, but not the other four, and a Maltese series is dissociated from all five but connected with the Bohemians and Spanish Bronze Age type. The last three may be considered to form a branch of the *D* group which may have to be severed from it later to form another distinct group. Without the evidence of additional material, however, there can be no sanction for disuniting them. As far as can be seen at present the Dynastic Egyptians are most closely bound to the Western European races. The British Neolithic population is almost invariably said to be of the "Mediterranean" type, but, judging by these methods, that is now entirely belied as, of all the *D* group series, it is the one farthest removed from the Mediterranean peoples, while it stands closest to the neighbouring Anglo-Saxon and Reihengräber types. The *D* group as a whole is extremely unlike both the *A* and *B* groups, but there are several intimate connections between series in the *C* and *D* groups (see Fig. 2). The closest of those links are between the Etruscans, Pompeians, Guanche and Basques of the *C* group and the British Iron Age and two 17th century London series of the *D* group. The *C* types are clearly distinguished from the *D* by having a closer resemblance to the *A* and *B* group series. Judging by these relations, which are based on the coefficients alone, the *C* group occupies a central position with the other three ranged round it such that each is closer to the *C* than to any other group. But the bond between the *C* and *D* groups is very appreciably closer than those between the *A* and *C*, or *B* and *C*.

A detailed comparison of single measurements has emphasised the difficulty—if not impossibility—of arriving at any rational classification in that way. The evidence afforded by one character, or pair of characters, will apparently never suggest the same arrangement as that suggested by another character, or pair of characters. That condition may be partly due to the fact that the probable errors of the means are of the same order as many of the inter-racial differences, but it must also be acknowledged to be due to the inherent nature of the problem. Any qualitative method which aimed at comparing more than two characters at the same time is more likely than not to prove infructuous. By expressing as a single constant the relative divergences of a considerable number of characters which may be varying independently, the method of the coefficient of racial likeness has an immense advantage over any other that has hitherto been used. But, having once established a classification by that means, the comparison of single measurements may help to confirm it and to reveal the salient characteristics of the groups distinguished. Before making that comparison it will clearly be a great advantage to have some measure of the average statistical significance of the differences found for each single measurement. In that respect there are enormous differences between the characters and, in general, those of the calvaria have greater significance than those of the facial skeleton. An ideal distinction would be made in the case of a single character if the means available for the series in the several groups

covered ranges of the variate which were peculiar to the group. That condition is not found for any measurement. For the greater number the inter-racial distributions for the four groups are such that every one overlaps every other one. Only one character has been found which is capable of making an absolute division between more than one of the groups and all the others: that is the cephalic index (see Fig. 7). All the absolute distinctions made between pairs of groups are given in Table XIX. Our attention is thus directed to all the greatest differences between the groups, but the method is only a crude one as the overlapping of the inter-racial distributions will depend on both the number of series in the groups and the sampling errors of the means. No importance can be attached to the fact that the distributions are absolutely distinct in the case of the characters which have few significant differences, and hence little attention should be paid to $100\,O_2/O_1$, $A\angle$, $N\angle$ and $100\,fmb/fml$ in Table XIX. The other characters there are all connected intimately with the length, breadth and height of the calvaria. From that evidence, and from the comparison of the mean values for the various groups in cases where the distributions overlap, the following relations have been suggested:

TABLE XIX.

Absolute Differences between Groups.

Groups	Characters														
A and *B*	—	*B*	—	100 *B*/*H*′	—	—	—	S_3	—	*U*	—	—	*A*∠	—	—
A „ *C*	100 *B*/*L*	—	*L*	—	100 *H*′/*L*	—	—	S_3	—	—	—	—	—	—	—
A „ *D*	100 *B*/*L*	—	*L*	—	—	*S*	—	S_3	—	*U*	—	—	—	—	—
B „ *C*	100 *B*/*L*	*B*	—	100 *B*/*H*′	—	—	—	—	—	—	*Q*′	—	*A*∠	*N*∠	—
B „ *D*	100 *B*/*L*	*B*	—	100 *B*/*H*′	—	—	—	—	100 S_1/S_2	—	—	100 O_2/O_1	*A*∠	—	—
C „ *D*	100 *B*/*L*	—	—	—	—	—	S_2	—	—	—	—	—	—	—	100 *fmb*/*fml*

A Group. The group is most clearly distinguished from the other three by its small *L*, *S*, S_3 and *U* and by its large index $100\,H'/L$. Those characters show little variation within the group. The breadths *J*, *B*′ and *B* are smaller than for the *B* group, while *J* and *B* (but not *B*′) are larger than for the *C* and *D* groups. The cephalic index $100\,B/L$ (= 80·2—84·0) and *Q*′ are of precisely the same order as for the *B* group, and both are appreciably greater than for the *C* and *D* groups. The occipital index is apparently larger than for the other groups. The index $100\,B/H'$ is smaller than for the *B* and larger than for the *D* group. The basio-bregmatic height (*H*′) shows a "group-mean" greater than those for the *C* and *D* groups, but that character has a more significant variation within the group than either *L* or *B*. The nucleus (cf. Fig. 3) is represented by the Serbo-Croats ($H' = 136{\cdot}4$), Greeks (136·1), Turks (135·9), Mediaeval Magyars (135·6), Modern Magyars (134·4) and Slovenes (133·6). The Rumanian *H*′ is still high (134·4) but the three series which branch off from the main group—Czechs (131·4), Great Russians (131·2) and Italians (Siena) (131·4)—have significantly lower means. This change in height is not associated with any change in length and breadth measurements and it cannot be supposed to be due to admixture with any types in the other groups.

The group as a whole is not distinguished by any facial measurements, but the Rumanians, Czechs and Great Russians are again differentiated from the other series by their small facial heights (NH', $G'H$ and O_2)*. No crossing with types in the other groups could account for that relation.

B Group. The group is most clearly distinguished from the other three by its large breadths (J, B' and B) and high index $100\,B/H'$. The length measurements (L, S, S_3) are greater than for the A group and less than for the C and D groups. Less important characters which appear to distinguish the group from the others are high indices $100\,S_1/S_2$ and $100\,G'H/GB$, a large capacity, narrow palate, large nasal and small alveolar angles. The orbital width is less and the orbital index greater than for the D group, but those characters do not differentiate the B group from the A and C groups. The cephalic index $100\,B/L$ (= 80·9—85·0) and Q' are the same as for the A group and greater than for the C and D groups. The height is appreciably less than for the A and D groups. The length, breadth and height vary considerably, and apparently independently, within the group.

C Group. The group is not distinguished from all others by any character which is extreme for European types, except in the ill-substantiated case of its low nasal index. Its divergences from the A and B groups have been noted above. The cephalic indices $100\,B/L$ (= 77·2—79·0) and $100\,B/H'$ and the calvarial breadth are all greater while L, S, S_3, U and H' are all less than for the D group. The lengths, breadths and heights of the series are all fairly constant.

D Group. The group is most clearly distinguished from all others by its great lengths (L, S, S_2, S_3 and LB) and low indices $100\,B/H'$ and $100\,B/L$ (= 71·1 – 77·1). The breadths J, B' and B are all smaller than for the A and B groups, while the calvarial breadth (but not J and B') is smaller than for the C group. The height is greater than for both the B and C groups, while Q' and the index $100\,H'/L$ are less than for the A and B groups. Its greater orbital width, and lower orbital index, distinguish the D from the B group, but not from the A and C groups. The greater variation of L, H', $100\,B/L$, $100\,H'/L$ and $100\,B/H'$ for series included in the D group suggests that it is less homogeneous than any one of the other three. The order in which the series are arranged by their mean lengths is very similar to the best linear arrangement which is suggested by the coefficients of racial likeness (cf. Figs. 6 and 7). Judging from the material dealt with in the present paper there can be no justification for subdividing the D group, but it is likely enough that it will be necessary to do that later.

E Group. A Predynastic Egyptian and a modern Sardinian series were found to be very closely related to one another, though markedly different from all others with which comparison is here made. The former is known to be connected with the Dynastic Egyptians, which could be placed without hesitation in the D group, by a number of links represented by the Dynastic Egyptian series. The discordance of the two aberrant ones is due almost entirely to their exceedingly small breadth

* Facial measurements are not available for the Italians (Siena).

measurements (B, B' and J); their capacities are also peculiarly small and the two nasal indices are high.

There is only one series which could not be assigned to one or other of the above groups. This is the series of modern Sicilians and it is unique on account of the small size of its facial and foraminal measurements. The indices of that type ($100\,B/L = 75{\cdot}6$) are not unlike those of several series belonging to the D group and some confirmation of the unusual size is clearly needed.

It will be seen that almost all the distinctions between the groups have been found for a certain number of calvarial characters which are intimately associated with the length, breadth and height. They are the ones most firmly established and far greater weight should be given to them than to any facial absolute or indicial measurements. But the calvarial characters which are able to differentiate the groups are precisely the ones which influence the coefficient to the greatest, and, indeed, to an almost overwhelming, extent. The evidence derived from the one method is not independent of the evidence derived from the other. The two are essentially associated and a far more convincing justification of the classification adopted might have been provided, either by a character which was not used in computing the coefficients, or by one used for that purpose which did not greatly influence them. No such character or combination of characters has been found. Means based on larger numbers of skulls may give more suggestive arrangements, but it seems to be unlikely that any facial measurements will be of much service in aiding the classification of European races. As far as they are able to, the comparisons of single measurements do appear to have justified the arrangement suggested by the coefficients.

The application of the method of the coefficient of racial likeness seems to have led to a rational classification of this first sample of European types. It has suggested that certain groups of races can be distinguished, although the divisions between them are not precise. The comparison with additional material, and the discovery of more intermediate types, may make it difficult, if possible at all, to retain that provisional grouping; but it seems probable that the types will always be found to cluster more closely at certain points of the whole continuous system and to be more diffuse at others. The marking-off of groups of closely allied races leads to a simplified conception of the whole scheme of relationship. A central group has been distinguished, though it is made up by six rather loosely connected types, and three other groups are found to be more closely connected with that central one than they are with one another. Each of the three peripheral groups appears to have a nucleus of types that are allied to one another in a peculiarly close way. The hypothesis that the central group represents an original centre of dispersion from which differing varieties branched off in three main directions is not a plausible one. It seems more reasonable to suppose that there were originally three independent centres of dispersion and that the central group of races has resulted from the crossing of some of the types derived from those three. But it may be better to wait until a classification based on quantitative data is firmly established before attempting to interpret it in terms of blood-relationship.

APPENDIX I.

REFERENCES.

The following abbreviations are used: *A. f. A.* = *Archiv für Anthropologie*; *A. p. A.* = *Archivio per l' Antropologia e la Ethnologia*; *A. S. D.* = *Die anthropologischen Sammlungen Deutschlands*, being Supplements to *A. f. A.*; *Bm.* = *Biometrika*; *M. A. G. W.* = *Mitteilungen der anthropologischen Gesellschaft in Wien*; *Z. f. M.* = *Zeitschrift für Morphologie und Anthropologie.*

(1) *Alsatians.* E. Adams: "Über postembryonale Wachstumsveränderungen und Rassenmerkmale im Bereiche des menschlichen Gesichtsschädels." *Z. f. M.* Bd. XX. (1917), S. 551—628. Modern skulls.

(2) *Anglo-Saxons.* G. M. Morant: "A First Study of the Craniology of England and Scotland from Neolithic to Early Historic Times, with Special Reference to the Anglo-Saxon Skulls in London Museums." *Bm.* Vol. XVIII. (1926), pp. 56—98.

(3) *Austrians (Mediaeval).* C. Toldt: "Die Schädelformen in den österreichischen Wohngebieten der Altslawen—einst und jetzt." *M. A. G. W.* Bd. XLII. (1912), S. 247—280. The skulls came from 11 cemeteries in Lower Austria and one in Moravia. All can be dated between A.D. 500 and 1200.

(4) *Badensians. A. S. D.* Heidelberg Catalogue (1896). Modern skulls.

(5) *Basques.* The means are of unpublished measurements taken by the present writer. The skulls (now preserved in the Musée Broca) came from Zaraus in the Spanish province of Guipuzcoa. Unsexed means of a number of these specimens were given by Paul Broca: "Sur les crânes basques de Saint Jean-de-Luz," *Bulletins de la Société d'Anthropologie de Paris*, 2e série, t. III. (1868), p. 43—101.

(6) *Bavarians (Altbayerisch).* J. Ranke: *Beiträge zur physischen Anthropologie der Bayern*, Bd. I. München (1892 ?), being offprints from *Beiträge zur Anthropologie und Urgeschichte Bayerns* (1883 etc.). The greater number of the skulls came from an ossuary at Aufkirchen near Munich, and they are probably all of modern date.

(7) *Bavarians (Waischenfeld).* J. Ranke, *op. cit.* (6). The sexed skulls from Waischenfeld (near Nuremberg) are dealt with on pp. 204—225. Some measurements of an unsexed series of 100 skulls from the same ossuary are given in an earlier section. The specimens are probably modern.

(8) *Bohemians (Mediaeval).* H. Matiegka: *Crania Bohemica*, 1. *Theil. Böhmens Schädel aus dem VI.—XII. Jahrhundert*, Prague (1891). The skulls came from 16 different cemeteries.

(9) *British Iron Age.* Morant, *loc. cit.* (2). The mean indices and angles were recalculated from the readings for individual skulls, so they differ slightly from the previously published values which had been found from the means of the component lengths. The skulls are chiefly of Romano-British date and the south of England is better represented than the north.

(10) *British Neolithic.* Morant, *loc. cit.* (2). The mean indices and angles were recalculated from individual readings. The skulls came from various scattered localities, England being better represented than Scotland.

(11) *Copts.* H. Münter: "Stellung der Kopten zu den Altägyptern. Eine kraniometrische Studie." *Zeitschrift für Anatomie und Entwicklungsgeschichte,* Bd. LXXIV. (1924), S. 614—683. The skulls came from a 7th to 10th century cemetery near Magageh, which is 100 miles south of Cairo. The writer is indebted to Dr Münter for permission to sex this series. The male means were reduced from the published individual measurements.

(12) *Czechs.* F. Schiff: "Beiträge zur Kraniologie der Czechen." *A. f. A.* Bd. XXXIX. (N.F. Bd. XI.) (1912), S. 253—292. The majority of these *Beinhausschädel* are probably modern. They came from a number of different localities in Bohemia.

(13) *Egyptians* (*26th—30th Dynasties*). K. Pearson and A. G. Davin: "On the Biometric Constants of the Human Skull." *Bm.* Vol. XVI. (1924), pp. 328—363. The series came from a single cemetery at Gizeh.

(14) *Egyptians* (*Predynastic*). C. D. Fawcett: "A Second Study of the Variation and Correlation of the Human Skull, with Special Reference to the Naqada Crania." *Bm.* Vol. I. (1902), pp. 408—467. The means used are those of the combined *A* and *Q* series given in *Bm.* Vol. XVII. (1925), pp. 14—15. Naqada is 20 miles north of Thebes.

(15) *English Bronze Age.* Morant, *loc. cit.* (2). The mean indices and angles were recalculated from individual readings. The type represented is believed to be that of the Bronze Age invaders, the Neolithic element having been eliminated as far as possible. Most of the skulls were found in the Midlands and north of England.

(16) *English* (*Farringdon St.*). B. G. E. Hooke: "A Third Study of the English Skull, with Special Reference to the Farringdon Street Crania." *Bm.* Vol. XVIII. (1926), pp. 1—55. This London cemetery was used in the 17th century.

(17) *English* (*Whitechapel*). W. R. Macdonell: "A Study of the Variation and Correlation of the Human Skull, with Special Reference to English Crania." *Bm.* Vol. III. (1904), pp. 191—244. A few additional measurements of these skulls were given in *Bm.* Vol. XVIII. (1926), pp. 28 and 29. The series came from a 17th century London plague pit.

(18) *Etruscans. A. S. D.* Leipzig Catalogue (1887). The skulls came from Etruscan and Roman tombs at Tarquinii.

(19) *French. A. S. D.* Munich Catalogue (1892). The skulls are of French soldiers who died in Munich during the Franco-Prussian war. Means were first given in *Bm.* Vol. III. (1904), p. 208.

(20) *Great Russians.* A. Tarenetzky: "Beiträge zur Craniologie der grossrussischen Bevölkerung der nördlichen und mittleren Gouvernements des europäischen

Russlands." *Mémoires de l'Académie Impériale des Sciences de St Pétersbourg*, VII^e^ série, Tome XXXII. (1884), No. 13, p. 1—81. The skulls are modern and nearly all of peasant origin.

(21) *Greeks.* A. Weisbach: "Die Schädelform der Griechen." *M. A. G. W.* Bd. XI. (1881), S. 72—97. Of the 95 modern ♂ skulls in this collection, 50 came from Europe and 45 from Asia Minor. Using 27 characters, the coefficient of racial likeness between the European (47·0) and Asiatic samples (42·7) is $-0{\cdot}04 \pm {\cdot}18$. That is the only negative coefficient recorded in this paper. The two series were combined to give the Greek means.

(22) *Guanche.* Detloff v. Behr: *Metrische Studien an 152 Guanchenschädeln.* Stuttgart (1908). These skulls, which are preserved in several German collections, came from caves, and they are certainly earlier than A.D. 1496, though otherwise of uncertain date.

(23) *Italians* (*Siena*). M. Vincenzo: "Il cranio fetale ed il cranio adulto." *A. p. A.* Vol. XLVIII. (1918), p. 56—123. Modern skulls.

(24) *Magyars* (*Mediaeval*). L. Bartucz: "Altungarische Schädel." *Ethnographische Sammlungen des ung. Nationalmuseums*, V. (1916). The skulls came from several 9th century cemeteries.

(25) *Magyars* (*Modern*). A. Weisbach: "Beiträge zur Kenntniss der Schädelformen österreichischer Völker. Nebst Bemerkungen über einige Veränderungen des deutschen Männer- und Weiberschädels im Alter zwischen 20 und 80 Jahren." *Zeitschrift der k. k. Gesellschaft der Ärzte in Wien, Medizinische Jahrbücher*, XX Jahrgang (1864), Heft I. S. 49—127, Heft IV. S. 33—86 and S. 119—154. The skulls are of Hungarian soldiers dying between 21 and 38 years. The measurements are defined more exactly in (29).

(26) *Maltese.* L. H. Dudley Buxton: "The Ethnology of Malta and Gozo." *Journal of the Royal Anthropological Institute*, Vol. LII. (1922), pp. 164—211. The series used was measured in the so-called "Mediaeval Chapel of Bones," but the skulls are probably of 17th and 18th century date. Fuller particulars regarding the measurements taken were kindly furnished by Mr Dudley Buxton.

(27) *Pompeians.* G. Nicolucci: *Crania Pompeiana.* Naples (1882).

(28) *Reihengräber.* The means given were obtained by pooling the measurements of Reihengräber skulls provided in the following papers:

(*a*) M. W. Hauschild: "Die menschlichen Skelettfunde des Gräberfeldes von Anderten bei Hannover." *Z. f. M.* Bd. XXV. (1925), S. 221—242.

(*b*) J. Gildemeister: "Ein Beitrag zur Kenntniss nordwestdeutscher Schädelformen." *A. f. A.* Bd. XI. (1879), S. 25—63. All the skulls came from Bremen: many of them were rather later in date than the Reihengräber (Merovingian) period, since

the majority could be dated between A.D. 900 and 1400. Only the measurements of those conforming to the *Reihengräbertypus* were used.

(*c*) H. A. Ried: "Skelette aus dem Reihengräberfelde zu Tettlham, Bezirksamt Laufen. Ein Beitrag zur physischen Anthropologie der Bajuwaren." *Beiträge zur Anthropologie und Urgeschichte Bayerns*, Bd. XVII. (1909), S. 63—95. The cemetery is in Upper Bavaria.

(*d*) J. Kollmann: "Schädel aus alten Grabstätten Bayerns." *Ibid.* Bd. I. (1877)' S. 151—221. The skulls came from nine Reihengräber cemeteries, all lying south of the Danube.

(*e*) H. Hölder: "Beiträge zur Ethnographie von Würtemberg." *A. f. A.* Bd. II. (1867), S. 51—100. The skulls came from 15 Reihengräber cemeteries in Würtemberg.

(*f*) H. Hölder: "Die Skelette der römischen Begräbnissplatzes in Regensburg mit Benutzung der Untersuchungen des Herrn Pfarrers J. Dahlem." *A. f. A.* Bd. XIII. (1882), Supplement, S. 1—51. The skulls came from three cemeteries of Merovingian date, two were typically Reihengräber, and the other was probably contemporary with them.

(*g*) J. Kollmann: "Beiträge zu einer Kraniologie der europäischen Völker." Fortsetzung. *A. f. A.* Bd. XIII. (1881), S. 179—232. The skulls came from a Reihengräber cemetery in Bavaria.

(*h*) A. Lissauer: "Crania Prussica. Ein Beitrag zur Ethnologie der preussischen Ostseeprovinzen." *Zeitschrift für Ethnologie*, Bd. VI. (1874), S. 188—226. Measurements are given of a few skulls of the Reihengräber type from the neighbourhood of Danzig. Their date is somewhat uncertain, but they may be all Merovingian.

(*i*) J. W. Spengel: *A. S. D.* Göttingen Catalogue (1874). A few of these skulls had been previously measured by Kollmann (*loc. cit.* (*d*)).

(*j*) A. Ecker: *A. S. D.* Freiburg Catalogue (1878).

(*k*) Rüdinger: *A. S. D.* Munich Catalogue (1892). These skulls had been previously measured by Kollmann (*loc. cit.* (*d*)), but the additional measurements given by Rüdinger could be used.

(*l*) M. W. Hauschild: "Die Göttingen Gräberschädel. Ein Beitrag zur Anthropologie Niedersachsens." *Z. f. M.* Bd. XXI. (1919—21), S. 365—438. Most of these skulls had been previously measured by Spengel (*loc. cit.* (*i*)).

Measurements of nearly 250 ♂ Reihengräber skulls were collected from these sources. Nearly all were found in Bavaria and Western Germany. Comparisons between various groups gave five insignificant coefficients, although they are all based on series with small $\bar{n}$'s. Six standard deviations were calculated, and four of them were less than the corresponding values for the Farringdon St. English series from a single cemetery (Ref. (16)). It was therefore legitimate to pool them.

(29) *Rumanians.* A. Weisbach: "Die Schädelform der Rumänen." *Denkschriften der kaiserlichen Akademie der Wissenschaften. Matematisch-naturwissenschaftliche Classe,* Bd. XXX. (1870), S. 107—136. Modern skulls of soldiers.

(30) *Sardinians.* W. L. H. Duckworth: "A Study of the Craniology of the Modern Inhabitants of Sardinia." *Z. f. M.* Bd. XIII. (1911), S. 439—504. The means used are those of the D_1 series.

(31) *Serbo-Croats.* A. Weisbach: "Die Serbokroaten der adriatischen Küstenländer." Supplement to *Zeitschrift für Ethnologie* (1884). Modern skulls.

(32) *Sicilians.* G. Mondio: "Studio sopra duecento teschi messinesi." *A. p. A.* Vol. XXVII. (1897), p. 267—380. The skulls are of 180 normal individuals and 20 criminals, the two groups being combined to give our ♂ means. The nasal measurements of Nos. 82, 84, 86 and 87 were excluded as they are certainly incorrect.

(33) *Slovenes.* A. Weisbach: "Die Schädelform der Slowenen." *M. A. G. W.* Bd. XLII. (1912), S. 59—84. Modern skulls.

(34) *Spanish Bronze Age.* H. and L. Siret: *Les premiers âges du métal dans le sud-est de l'Espagne.* Antwerp (1887). The skull measurements are given in the section on *Ethnologie* (pp. 267—396) by V. Jacques. The means given here are of the pooled Argar, Gerúndia and Puerto-Blanco series.

(35) *Swedish Prehistoric.* G. Retzius: *Crania Suecica Antiqua. Eine Darstellung der Schwedischen Menschen-Schädel aus dem Steinzeitalter, dem Bronzezeitalter und dem Eisenzeitalter....* Stockholm (1900); and C. M. Fürst: "Zur Kraniologie der Schwedischen Steinzeit." *Kungl. Svenska Vetenskapsakademiens Handlingar,* Bd. XLIX. (1912). No. 1. The combined Neolithic series of Retzius and Fürst ($\bar{n} = 29{\cdot}5$) have a coefficient with the combined Bronze and Iron Age series of Retzius ($\bar{n} = 20{\cdot}2$) of $+0{\cdot}62 \pm {\cdot}20$ for 22 characters. The means obtained by pooling all four series have been used. Standard deviations were calculated for five characters; four of them are less than the corresponding values for the Farringdon St. English series from a single cemetery.

(36) and (37). *Swiss* (*Sierre*) and *Swiss* (*Valais*). E. Pittard: "Crania Helvetica. I. Les crânes valaisans de la vallée du Rhône." *Mémoires de l'Institut national genevois,* T. XX. (1909—1910). The skulls came from 11 ossuaries in the canton, and all are of mediaeval or modern date. A series from Sierre ($\bar{n} = 61{\cdot}0$) in the lower valley is distinguished from all others by its significantly lower cephalic index. It gives a coefficient with all the other skulls in the lower valley (138·3) of $2{\cdot}82 \pm {\cdot}25$ for 28 characters. The coefficient between the latter group and all skulls from the upper valley (197·6) is $1{\cdot}39 \pm {\cdot}25$. For the Sierre series and all from the upper valley the coefficient is $4{\cdot}14 \pm {\cdot}25$. From this evidence it was thought advisable to calculate the means for two groups: the first comprises the Sierre series alone, and the second is made up by the pooled data for all the other ossuaries.

(38) *Turks.* A. Weisbach: "Die Schädelform der Türken." *M. A. G. W.* Bd. III. (1873), S. 185—245. The skulls were obtained from Mohammedan cemeteries in Constantinople. They are probably all modern and the greater number are certainly skulls of Turks.

(39) *Tyrolese.* M. Holl: "Ueber die in Tirol vorkommenden Schädelformen." *M. A. G. W.* Bd. XIV. (1884), S. 77—116. The skulls were measured in 13 different *Beinhäuser.*

(40) *Vorarlberger.* M. Holl: "Ueber die in Vorarlberg vorkommenden Schädelformen." *M. A. G. W.* Bd. XVIII. (1888), S. 1—24. The skulls were measured in 14 different *Beinhäuser.*

(41) *Würtemberger. A. S. D.* Tübingen Catalogue (1902). Means of these modern skulls were first given in *Bm.* Vol. III. (1904), p. 208.

APPENDIX II.

DEFINITIONS OF MEASUREMENTS.

The index-letters denoting measurements in the following list are those habitually used by workers in the Biometric Laboratory. The numbers in brackets preceded by M. are those in Martin's list (*op. cit.* pp. 519—538). References are made to the following sources which give definitions of cranial measurements:

(*a*) "Verständigung über ein gemeinsames craniometrisches Verfahren." *Archiv für Anthropologie,* Bd. XV. (1884), S. 1—8. Known as the *Frankfurter Verständigung* (denoted below by *F.V.*).

(*b*) Paul Broca: "Instructions craniologiques et craniométriques de la Société d'Anthropologie de Paris." *Mémoires de la société d'anthropologie de Paris,* 2e série, Tome 2 (1875), pp. 1—203.

(*c*) F. v. Luschan: "Die Konferenz von Monaco." *Korrespondenz-Blatt der deutschen Gesellschaft für Anthropologie, Ethnologie und Urgeschichte,* Jahrgang XXXVII. (1906), S. 53—62. Von Luschan's measurements are based on those of the Monaco Conference, but several are modified.

(*d*) Rudolf Martin: *Lehrbuch der Anthropologie.* Jena (1914). The numbers denoting Martin's definitions of measurements are precisely the same in the second edition of the *Lehrbuch* (1928).

All chord and arc measurements are in mms.

C = capacity. Various methods were used to determine this measurement, but all readings were accepted and compared. L = greatest glabella-occipital length (M. 1). *F.V.* Horizontal L (*Gerade Länge*) = length from glabella, "zu dem am meisten vorragenden Punkt des Hinterhaupts parallel mit der Horizontalebene des Schädels gemessen" (M. 1 *a*). That is not precisely the same as the Biometric Laboratory L' as the Frankfurt measurement is taken in the median sagittal plane, and the other is a maximum projection. Both L and *F.V.* Horizontal L are given for the Tyrolese and Würtemberger, and the first exceed the second by 1·6 and 1·5 respectively. For the French and Badensians the horizontal lengths are given, but the L's are not, so the latter were reconstructed by adding 1·6 to the former. B = maximum horizontal breadth (M. 8). H' = basio-bregmatic height (M. 17). H = basion to a point vertically above it with regard to the Frankfurt horizontal plane (F.V. Höhe, M. 18). Maximum H = basion to farthest removed point in median sagittal plane. For series giving means of both H and H' for more than 50 skulls, the former exceed the latter by the following amounts: Farringdon St. English 0·7, Slovenes 0·8, Etruscans 1·3. The equation, $H - H' = 1{\cdot}0$, was used to give a reconstructed H' where H only was given. For series giving means of both the maximum H and H' for 40 or more skulls the former exceeds the latter by the following amounts: Rumanians 2·0, Serbo-Croats 2·3, Turks 2·6, and Greeks 3·8. The equation, maximum $H - H' = 2{\cdot}7$, was used to give a reconstructed H' for the Great Russians. LB = basion to nasion (M. 5). B' = minimum

frontal breadth (M. 9). S = arc nasion to opisthion (M. 25). S_1 = arc nasion to bregma (M. 26). S_2 = arc bregma to lambda (M. 27). S_3 = arc lambda to opisthion (M. 28). S_3' = chord lambda to opisthion (M. 31). U = horizontal circumference measured through the ophryon and directly above the superciliary ridges (M. 23 *a*). Glabella U = horizontal circumference measured through the glabella (M. 23). Q' = transverse circumference measured from one auricular point* (Martin's "porion") to the other perpendicular to the Frankfurt horizontal plane (M. 24 *b*). Bregmatic Q' = transverse circumference from one auricular point to the other passing through the bregma (M. 24). Broca's Q' = *courbe transversale sus-auriculaire*, from Martin's auricular point on one side to the other passing through the bregma (M. 24 *a*). Weisbach's Q' = "Querumfang zwischen denselben Punkten (oberhalb der Mitte der äusseren Ohrlöcher) in senkrechter Richtung über den Scheitel" (Ref. Appendix I, No. (29), meas. nos. 9 and 10). Weisbach determined his horizontal from the direction given by the upper edge of one of the zygomatic arches. When using the transverse circumferences in computing coefficients of racial likeness, comparisons were only made between pairs said to have been determined in identical ways. To give the "group-means" in Table XVIII, however, several Q''s were reconstructed from the similar arcs. The following equations, given by series for which two of the transverse arcs were measured, were used: Bregmatic $Q' - Q' = 1{\cdot}8$, Q' – Broca's $Q' = 14{\cdot}7$, Q' – Weisbach's $Q' = 14{\cdot}7$. The last assumes that Broca's Q' = Weisbach's Q'. fml = basion to opisthion (M. 7). fmb = greatest breadth of foramen magnum (M. 16). $G'H$ = nasion to alveolar point (M. 48). GL = basion to alveolar point. This is not the same as Martin's *Gesichtslänge* (40) which is measured from basion to prosthion. GB = between lowest points on zygomatic-maxillary sutures (M. 46). J = greatest breadth between zygomatic arches (M. 45). NH' = nasion to base of anterior nasal spine (M. 55). NH, R or L = nasion to lowest edge of pyriform aperture on the right or left side. For the Farringdon St. and Whitechapel English series NH, R exceeds NH' by 0·8 and 0·9 respectively. The equation $NH - NH' = 0{\cdot}8$ was used to give a reconstructed NH' from NH. NB = greatest breadth of pyriform aperture (M. 54). O_1, R or L = greatest breadths of the orbits using Fawcett's curvature method (*Biometrika*, Vol. I. (1902), pp. 430—431). This method has been supposed to be the same as the F.V. *Grösste Breite des Augenhöhleneinganges* and as Martin's 51. O_1', R or L = greatest breadths of the orbits measured from the dacrya (M. 51 *a*). Schmidt's O_1, R or L = greatest breadths of the orbits, "von dem Punkt, wo die hintere Kante der Thränengrube mit der Stirn-Thränenbeinnaht zusammentrifft" (E. Schmidt: *Anthropologische Methoden*, Leipzig (1888), S. 249) (M. 51 *b*). The definition of Broca's orbital breadth has, unfortunately, been interpreted in two different ways (see P. Topinard, *Éléments d'Anthropologie Générale*, Paris (1885), pp. 949—950). Where followers of Broca's methods have said, without further comment, that they measured from the dacryon it has been assumed that they actually did do so, hence their breadths are supposed the same as our O_1'. But most French craniometricians have used the

* These are the auricular points used by workers in the Biometric Laboratory (see *Biometrika*, Vol. XIV, p. 201), and they may be supposed to correspond exactly with the "porions" of Martin.

lacrymal point as the terminal, so their breadth is Schmidt's O_1. O_2, R and L = greatest heights of orbits (M. 52). All orbital heights have been compared directly whether they were defined to have been measured perpendicular to O_1, O_1' or Schmidt's O_1. G_1 = length of palate from tip of posterior nasal spine to the intersection of the median sagittal plane and an imaginary line tangential to the inner alveolar margins of the middle incisors (M. 62 *a*). G_1' = from base of spine to the same anterior terminal (M. 62). F.V. G_1 = from tip of spine, "bis zur inneren Lamelle des Alveolarrandes zwischen den mittleren Schneidezähnen" (F.V. No. 27). The anterior terminal appears to be insufficiently defined, but several workers have provided the measurement without commenting on that fact. Their means have been compared with one another. Broca's G_1 = from tip of spine to a point, "derrière les incisives médianes, sur la lèvre postérieure du bord alvéolaire" (*loc. cit.* p. 77). Von Luschan's G_1 is taken, "parallel mit der Mittellinie, von der Mitte des hinteren Alveolarrandes eines ersten Schneidezahnes bis zum Rande der Ausbuchtung neben dem hinteren unteren Nasenstachel" (*loc. cit.* No. 24, S. 56). Weisbach's G_1 = "Gaumenlänge in der Mittellinie ohne die hintere Spina" (Ref. Appendix I, No. (29), meas. no. 58). Ranke's G_1' = "von der Basis des harten Gaumens, Spina nasalis posterior, bis zur inneren Lamelle des Alveolarrandes des Oberkiefers zwischen den mittleren Schneidezähnen" (Ref. Appendix I, No. (6), S. 151). G_2 = breadth of palate between inner alveolar walls of second molars (M. 63). Broca's G_2 = "le maximum d'écartement de la courbe intérieure de l'arcade alvéolaire" (*loc. cit.* p. 77) (M. 63 *a*). Weisbach's G_2 = "zwischen den inneren Lamellen des Zahnfächerfortsatzes am hinteren Ende" (Ref. Appendix I, (29), meas. no. 57). Ranke's G_2 = "an den beiden hinteren Endpunkten des Gaumens resp. der inneren Alveolarränder gemessen" (Ref. Appendix I, (6), S. 151). This palatal breadth may be the same as Weisbach's and as Martin's 63 (1), but the definitions are not full enough to decide this point with certainty.

The only index which needs a special definition is the occipital,

$$Oc.\ I = 100\,\frac{S_3}{S_3'}\sqrt{\frac{S_3}{24\,(S_3 - S_3')}}.$$

Values for the individual skulls were found with the aid of Miss Tildesley's table of the function (*Biometrika*, Vol. XIII. (1921), pp. 261—262). Alveolar $P\angle$ = profile angle between the Frankfurt horizontal plane and the chord joining nasion to alveolar point. Prosthion $P\angle$ = angle between the same plane and the chord joining nasion to prosthion (M. 72). The nasal ($N\angle$), alveolar ($A\angle$) and basal ($B\angle$) angles of the fundamental triangle were found from its sides ($G'H$, GL and LB) with the aid of Pearson's trigonometer, as described by Fawcett (*Biometrika*, Vol. I. (1902), p. 418).

APPENDIX III.

TABLES OF MEAN MEASUREMENTS.

Tables XX—XXIV give the mean measurements of the 41 series dealt with in this paper. The absolute measurements in square brackets were derived from the means of similar measurements (as described in Appendix II) by the addition or subtraction of quantities which are supposed constant for all the racial types. The median sagittal arcs S, S_1 and S_3 in curled brackets were found by adding the means of their component parts. Indices and angles in curled brackets were found from the means of their component lengths instead of from individual values. For indices which express one length as a percentage of another that procedure may not be theoretically correct, but actually the mean indices for the same skulls given by the direct and indirect methods are seldom found to differ by more than 0·1 of a unit. In the case of the complex Occipital Index (*Oc. I*), however, the mean derived from individual values always exceeds the one given by the mean lengths, and for 14 series the differences range from 0·4 to 1·2. The indices in both curled and square brackets have one, or both, of their component lengths determined indirectly from a similar mean measurement. The greater number of the means were reduced by the present writer from the published tables of individual measurements.

TABLE XX.

Mean Measurements of A Group Series.

Character	Serbo-Croats	Greeks	Turks	Magyars (Mediaeval)	Magyars (Modern)	Slovenes	Rumanians	Czechs
C	1524·6 (79)	1489·0 (86)	1457·1 (39)	1493·4 (27)	1421·6 (28)	1406·2 (48)	1478·9 (38)	1438·4 (108)
L	175·4 (80)	176·4 (95)	175·4 (78)	179·7 (31)	177·2 (29)	175·5 (60)	175·3 (40)	175·9 (108)
B	147·5 (80)	143·1 (95)	145·8 (78)	147·6 (31)	145·1 (29)	146·1 (60)	145·3 (40)	145·6 (108)
H	—	—	—	—	—	134·4 (60)	—	—
H'	136·4 (80)	136·1 (92)	135·9 (70)	135·6 (26)	134·4 (29)	133·6 (60)	134·4 (40)	131·4 (108)
Maximum *H*	138·7 (80)	139·9 (92)	138·5 (73)	—	—	—	136·4 (40)	—
LB	102·1 (80)	101·0 (88)	101·5 (71)	100·8 (27)	101·3 (29)	99·9 (60)	100·2 (40)	98·7 (108)
B'	98·2 (79)	97·1 (87)	94·4 (75)	96·7 (29)	96·1 (28)	97·5 (60)	95·7 (40)	97·4 (107)
S	{366·5 (80)}	{367·2 (94)}	{364·7 (70)}	366·5 (30)	{363·1 (29)}	{359·8 (60)}	{362·5 (40)}	360·0 (108)
S_1	128·1 (80)	125·8 (95)	126·3 (78)	128·9 (27)	125·4 (29)	126·6 (60)	126·1 (40)	126·1 (108)
S_2	126·2 (80)	128·8 (95)	126·6 (78)	124·1 (30)	125·0 (29)	123·8 (60)	125·0 (40)	122·4 (101)
S_3	112·2 (80)	112·6 (94)	111·8 (70)	113·9 (29)	112·7 (29)	109·4 (60)	111·5 (40)	111·5 (101)
S_3'	95·5 (80)	95·9 (94)	95·1 (71)	95·1 (29)	93·9 (29)	92·4 (60)	94·8 (40)	92·2 (101)
U	—	—	—	—	—	510·1 (60)	—	511·9 (108)
Glabella *U*	513·9 (79)	510·6 (95)	513·9 (78)	519·3 (29)	515·7 (29)	—	511·7 (40)	—
Q	—	—	—	—	—	314·6 (60)	—	320·5 (108)
Bregmatic *Q*	—	—	—	322·6 (28)	—	—	—	—
Weisbach's *Q*	322·7 (80)	316·0 (94)	320·0 (69)	—	310·0 (29)	—	313·9 (40)	—
fml	35·9 (80)	36·3 (91)	35·9 (65)	37·7 (25)	37·2 (29)	—	36·7 (40)	35·4 (108)
fmb	31·2 (80)	30·8 (86)	30·4 (65)	30·9 (27)	31·1 (29)	—	30·5 (40)	29·6 (108)
G'H	70·2 (80)	71·8 (93)	71·9 (66)	72·9 (28)	69·8 (29)	71·0 (60)	67·9 (40)	67·3 (107)
GL	93·7 (80)	94·8 (91)	94·7 (60)	—	97·4 (29)	94·6 (60)	94·8 (40)	92·3 (107)
GB	94·9 (80)	93·4 (91)	94·6 (56)	97·2 (26)	94·9 (29)	93·8 (60)	93·1 (40)	93·2 (108)
J	136·5 (80)	132·1 (91)	134·0 (64)	134·7 (28)	134·4 (29)	134·2 (60)	133·1 (40)	131·3 (108)
NH'	51·7 (79)	51·8 (77)	—	53·8 (28)	—	[49·7 (60)]	—	49·8 (105)
NH, *R* or *L*	—	—	—	—	—	50·5 (60)	—	—
NB	24·5 (79)	24·5 (76)	—	25·6 (28)	—	23·9 (60)	—	23·85 (105)
O_1, *R* or *L*	—	—	—	41·0 (27)	—	39·2 (60)	—	—
O_1', *R* or *L*	39·7 (80)	39·3 (93)	38·7 (65)	—	39·6 (29)	—	38·9 (40)	38·8 (108)
O_2, *R* or *L*	33·4 (80)	34·3 (93)	34·7 (65)	34·6 (28)	32·7 (29)	33·0 (60)	31·9 (40)	32·9 (108)

TABLE XX—(*continued*).

Character	Serbo-Croats	Greeks	Turks	Magyars (Mediaeval)	Magyars (Modern)	Slovenes	Rumanians	Czechs
F.V. G_1	—	—	—	—	—	45·7 (60)	—	—
G_1'	—	—	—	51·5 (26)	—	—	—	—
von Luschan's G_1	—	—	—	—	—	—	—	44·0 (31)
Weisbach's G_1	—	—	45·2 (62)	—	52·0 (29)	—	46·1 (40)	—
G_2	—	—	—	42·6 (28)	—	38·1 (60)	—	40·9 (34)
Weisbach's G_2	—	—	39·4 (63)	—	39·0 (29)	—	38·4 (40)	—
100 B/L	84·0 (80)	81·2 (95)	83·2 (78)	82·3 (31)	{81·9 (29)}	83·4 (60)	82·8 (40)	82·8 (108)
100 H'/L	{77·8 (80)}	{77·1 (92)}	{77·5 (70)}	75·5 (27)	{75·8 (29)}	{76·1 (60)}	{76·7 (40)}	74·8 (108)
100 H/L	—	—	—	—	—	{76·5 (60)}	—	—
100 B/H'	{108·1 (80)}	{105·2 (92)}	{107·2 (70)}	{108·9 (26)}	{108·0 (29)}	{109·2 (60)}	{108·1 (40)}	{110·8 (108)}
100 B/H	—	—	—	—	—	{108·7 (60)}	—	—
100 $(B-H')/L$	{+6·3 (80)}	{+4·0 (92)}	{+5·7 (70)}	{+6·7 (26)}	{+6·4 (29)}	{+7·1 (60)}	{+6·2 (40)}	{+8·1 (108)}
100 *fmb*/*fml*	{86·9 (80)}	{84·8 (86)}	{84·7 (65)}	{81·8 (25)}	{83·6 (29)}	—	{83·1 (40)}	{83·6 (108)}
Oc. I	62·8 (80)	62·9 (94)	63·3 (70)	{60·2 (29)}	—	62·1 (60)	62·7 (40)	60·5 (101)
100 NB/NH'	{47·4 (79)}	{47·3 (76)}	—	47·1 (27)	—	[{48·1 (60)}]	—	48·1 (105)
100 NB/NH, R or L	—	—	—	—	—	{47·1 (60)}	—	—
100 O_2/O_1, R or L	—	—	—	85·1 (26)	—	{83·8 (60)}	—	—
100 O_2/O_1', R or L	{84·1 (80)}	{87·3 (91)}	{89·7 (65)}	—	{82·6 (29)}	—	{82·0 (40)}	84·2 (108)
100 $G'H/GB$	{74·8 (80)}	{76·8 (91)}	{76·0 (56)}	{75·0 (26)}	{73·6 (29)}	{75·6 (60)}	{72·9 (40)}	72·2 (104)
100 G_2/F.V. G_1	—	—	—	—	—	{83·4 (60)}	—	—
100 G_2/G_1'	—	—	—	83·2 (25)	—	—	—	—
100 G_2/von Luschan's G_1	—	—	—	—	—	—	—	{93·0 (31)}
100 Weisbach's G_2/Weisbach's G_1	—	—	{87·2 (62)}	—	{75·0 (29)}	—	{83·2 (40)}	—
$N\angle$	{62°·4 (80)}	{63°·9 (88)}	{63°·5 (60)}	—	{66°·4 (29)}	{64°·5 (60)}	{65°·3 (40)}	{64°·5 (107)}
$A\angle$	{75°·6 (80)}	{73°·2 (88)}	{73°·6 (60)}	—	{72°·6 (29)}	{72°·5 (60)}	{74°·0 (40)}	{74°·4 (107)}
$B\angle$	{42°·0 (80)}	{42°·9 (88)}	{42°·9 (60)}	—	{41°·0 (29)}	{43°·0 (60)}	{40°·7 (40)}	{41°·1 (107)}
Alv. P$\angle$	—	—	—	—	—	—	—	88°·3 (97)

TABLE XXI.

Mean Measurements of B Group Series.

Character	English Bronze Age	Swiss (Sierre)	Swiss (Valais)	Bavarians (Altbayerisch)	Tyrolese	Vorarlberger	Badensians	Würtemberger
C	—	1547·1 (28)	1542·7 (159)	1503·5 (100)	—	—	1524·9 (78)	1493·8 (91)
L	184·5 (48)	182·1 (74)	177·7 (385)	180·6 (100)	180·1 (149)	177·0 (394)	[183·1 (90)]	179·5 (97)
F.V. Horiz. *L*	—	—	—	—	178·5 (149)	—	181·5 (90)	178·0 (95)
B	149·9 (89)	149·0 (74)	151·0 (385)	150·5 (100)	151·2 (149)	148·0 (394)	148·6 (87)	147·9 (96)
H	141·3 (3)	—	—	133·8 (99)	133·6 (136)	131·0 (386)	132·5 (82)	130·9 (93)
H'	134·9 (25)	133·5 (65)	132·9 (372)	[132·8 (99)]	[132·6 (136)]	[130·0 (386)]	[131·5 (82)]	[129·9 (93)]
LB	102·9 (27)	101·0 (63)	100·2 (366)	100·3 (85)	100·6 (131)	99·0 (289)	99·7 (98)	98·6 (96)
B'	99·7 (43)	99·9 (73)	99·6 (382)	101·0 (72)	101·0 (125)	100·0 (375)	99·4 (99)	98·6 (96)
S	376·6 (62)	{370·3 (67)}	{366·4 (365)}	365·1 (80)	372·9 (140)	365·8 (388)	370·5 (83)	367·2 (93)
S_1	131·1 (61)	{128·0 (73)}	{128·3 (382)}	127·5 (92)	—	—	129·1 (73)	128·0 (93)
S_2	128·1 (57)	125·8 (73)	122·4 (381)	—	—	—	124·3 (66)	123·2 (93)
S_3	117·9 (42)	{116·5 (67)}	{115·6 (365)}	—	—	—	116·8 (72)	115·9 (91)
U	535·6 (81)	528·1 (69)	523·6 (379)	—	529·3 (148)	521·0 (390)	523·4 (98)	517·8 (96)
Q	333·9 (7)	—	—	329·7 (87)	329·0 (141)	324·2 (376)	320·1 (82)	324·0 (95)
Bregmatic *Q*	320·5 (15)	—	—	—	—	—	—	—
Broca's *Q*	—	315·1 (69)	318·8 (374)	—	—	—	—	—
fml	36·1 (20)	35·7 (62)	36·0 (351)	37·0 (71)	—	—	36·5 (96)	36·2 (96)
fmb	31·1 (14)	30·3 (61)	30·5 (345)	30·7 (71)	—	—	30·9 (99)	31·2 (96)
G'H	69·1 (30)	69·7 (55)	70·9 (293)	70·8 (56)	74·5 (62)	71·8 (237)	71·4 (99)	71·5 (76)
GL	96·4 (20)	97·6 (51)	96·8 (294)	—	—	—	94·9 (98)	—
GB	98·0 (11)	—	—	95·1 (51)	97·0 (119)	93·2 (240)	93·8 (91)	92·5 (94)
J	138·5 (40)	137·2 (54)	136·3 (310)	135·0 (56)	135·7 (112)	131·8 (254)	134·7 (85)	133·3 (94)
NH'	51·8 (16)	49·8 (64)	50·1 (354)	50·9 (70)	[53·0 (135)]	[50·6 (240)]	[51·2 (99)]	[50·7 (94)]
NH, *R* or *L*	49·1 (13)	—	—	—	53·8 (135)	51·4 (240)	52·0 (99)	51·5 (94)
NB	25·0 (28)	23·8 (64)	24·1 (351)	24·8 (70)	25·5 (132)	24·2 (236)	23·9 (99)	23·9 (94)
O_1, *R* or *L*	44·0 (14)	—	—	39·9 (71)	41·9 (138)	39·2 (237)	—	39·8 (96)
O_1', *R* or *L*	38·0 (1)	36·5 (66)	36·8 (355)	—	—	—	—	—
Schmidt's O_1, *R* or *L*	39·7 (17)	—	—	—	—	—	38·7 (99)	—
O_2, *R* or *L*	33·0 (30)	32·5 (66)	32·8 (355)	33·7 (71)	36·0 (138)	33·35 (237)	34·0 (99) *L*	34·1 (96)

TABLE XXI—(*continued*).

Character	English Bronze Age	Swiss (Sierre)	Swiss (Valais)	Bavarians (Altbayerisch)	Tyrolese	Vorarlberger	Badensians	Württemberger
F.V. G_1	—	—	—	—	—	—	41·9 (99)	51·7 (75)
Ranke's G_1'	—	—	—	44·3 (55)	—	—	—	—
Broca's G_1	54·4 (8)	54·3 (45)	54·45 (250)	—	—	—	—	—
G_2	42·4 (10)	—	—	33·2 (53)	—	—	35·4 (99)	38·1 (73)
Ranke's G_2	—	—	—	37·3 (61)	—	—	—	—
Broca's G_2	—	36·5 (46)	37·4 (266)	—	—	—	—	—
100 B/L	80·9 (42)	{81·9 (74)}	{85·0 (385)}	83·2 (100)	84·0 (149)	83·5 (394)	[{81·2 (87)}]	82·5 (96)
100 H'/L	73·7 (24)	{73·3 (65)}	{74·8 (372)}	[{73·5 (99)}]	[{73·6 (136)}]	[{73·5 (386)}]	[{71·8 (82)}]	[{72·4 (93)}]
100 H/L	76·0 (3)	—	—	74·2 (99)	74·2 (136)	74·0 (386)	[{72·4 (82)}]	73·0 (93)
100 B/H'	111·0 (24)	{111·6 (65)}	{113·6 (372)}	[{113·3 (99)}]	[{114·0 (136)}]	[{113·8 (336)}]	[{113·0 (82)}]	[{113·9 (93)}]
100 B/H	104·2 (3)	—	—	{112·5 (99)}	{113·2 (136)}	{112·9 (386)}	{112·2 (82)}	{113·0 (93)}
100 $(B-H')/L$	{+8·1 (25)}	{+8·5 (65)}	{+10·2 (372)}	[{+9·8 (99)}]	[{+10·3 (136)}]	[{+10·2 (386)}]	[{+9·3 (82)}]	[{+10·0 (93)}]
100 *fmb/fml*	86·6 (14)	{84·7 (61)}	{84·7 (345)}	83·2 (71)	—	—	85·2 (96)	{86·4 (96)}
100 NB/NH'	48·4 (15)	{47·8 (64)}	{48·0 (351)}	48·7 (70)	[{48·1 (132)}]	[{47·7 (236)}]	[{46·7 (99)}]	[{47·2 (94)}]
100 NB/NH, R or L	51·4 (13)	—	—	—	47·7 (132)	47·5 (232)	46·1 (99)	46·6 (93)
100 O_2/O_1, R or L	78·5 (13)	—	—	84·5 (71)	86·1 (138)	85·2 (236)	—	85·9 (96)
100 O_2/O_1', R or L	86·8 (1)	{89·0 (66)}	{89·1 (355)}	—	—	—	—	—
100 O_2/Schmidt's O_1, R or L	80·4 (17)	—	—	—	—	—	87·9 (99)	—
100 $G'H/GB$	69·7 (10)	—	—	74·5 (48)	75·7 (59)	77·1 (235)	{76·1 (91)}	78·1 (74)
100 G_2/F.V. G_1	—	—	—	—	—	—	84·8 (99)	74·2 (66)
100 G_2/Ranke's G_1'	—	—	—	74·4 (47)	—	—	—	—
100 Ranke's G_2/Ranke's G_1'	—	—	—	84·6 (53)	—	—	—	—
100 G_2/Broca's G_1	78·3 (8)	—	—	—	—	—	—	—
100 Broca's G_2/Broca's G_1	—	{67·2 (45)}	{68·7 (250)}	—	—	—	—	—
$N\angle$	64°·5 (17)	{66°·9 (51)}	{66°·5 (289)}	—	—	—	{65°·0 (98)}	—
$A\angle$	75°·3 (17)	{72°·1 (51)}	{71°·5 (289)}	—	—	—	{72°·0 (98)}	—
$B\angle$	40°·2 (17)	{41°·0 (51)}	{42°·0 (289)}	—	—	—	{42°·9 (98)}	—
Alv. $P\angle$	84°·2 (5)	—	—	—	—	—	—	—
Prosth. $P\angle$	—	—	—	89°·1 (40)	—	—	85°·0 (97)	86°·4 (77)

TABLE XXII.

Mean Measurements of C and E Group Series.

Character	C Group						E Group	
	Basques	Guanche	Copts	Pompeians	Etruscans	French	Predynastic Egyptians (Naqada *A* and *Q*)	Sardinians
C	—	1503·9 (76)	—	1503·6 (51)	1456·0 (78)	1473·1 (56)	1388·6 (61)	—
L	185·8 (39)	185·8 (83)	181·3 (38)	181·6 (55)	183·0 (86)	[181·6 (56)]	184·7 (101)	185·2 (70)
F.V. Horiz. *L*	—	—	—	—	—	180·0 (56)	—	—
B	143·5 (39)	143·8 (83)	140·95 (38)	142·6 (55)	143·7 (87)	143·4 (56)	132·7 (88)	132·3 (70)
H	130·5 (37)	—	129·3 (38)	—	134·7 (79)	130·7 (56)	136·4 (71)	—
H′	130·8 (39)	131·1 (79)	129·0 (38)	131·3 (50)	133·4 (80)	[129·7 (56)]	133·8 (70)	130·6 (63)
LB	99·6 (39)	99·9 (79)	98·4 (38)	99·3 (51)	101·0 (80)	99·7 (56)	101·4 (69)	100·5 (64)
B′	97·1 (39)	97·2 (82)	94·3 (38)	98·7 (55)	96·1 (87)	96·2 (56)	92·6 (101)	—
S	375·2 (39)	368·9 (78)	365·9 (38)	366·7 (51)	375·6 (81)	366·0 (56)	372·6 (90)	—
S_1	129·5 (39)	127·3 (82)	125·3 (38)	125·5 (52)	—	126·7 (56)	127·7 (100)	—
S_2	126·0 (39)	124·5 (81)	125·4 (38)	124·1 (52)	—	123·8 (54)	130·2 (95)	—
S_3	119·8 (39)	117·1 (79)	115·6 (38)	115·9 (50)	—	118·3 (53)	116·9 (85)	—
S_3'	96·8 (39)	97·7 (79)	95·1 (38)	—	101·6 (81)	—	96·5 (84)	—
U	527·1 (39)	522·6 (80)	—	520·1 (54)	523·6 (85)	518·2 (56)	510·4 (90)	—
Glabella *U*	—	—	513·2 (38)	—	—	—	—	515·2 (70)
Q′	313·5 (37)	316·0 (76)	—	—	317·5 (86)	312·2 (56)	302·9 (87)	—
Bregmatic *Q′*	313·2 (39)	—	309·4 (38)	—	—	—	—	—
Broca's *Q′*	—	301·3 (78)	—	—	—	—	—	—
fml	36·4 (39)	37·4 (77)	35·8 (38)	35·4 (47)	36·0 (80)	—	35·6 (70)	—
fmb	30·9 (39)	31·8 (76)	—	30·1 (47)	30·8 (77)	—	29·5 (70)	—
G′H	70·7 (31)	69·6 (79)	71·3 (37)	70·7 (54)	70·7 (84)	68·4 (56)	69·7 (52)	68·5 (45)
GL	90·7 (37)	94·0 (76)	—	93·5 (50)	95·4 (78)	—	96·7 (46)	96·5 (43)
GB	90·1 (31)	99·9 (77)	94·4 (38)	—	93·8 (76)	92·5 (56)	95·9 (60)	—
J	128·8 (34)	134·5 (50)	127·9 (38)	—	131·9 (81)	130·7 (56)	125·9 (37)	127·7 (59)
NH′	51·9 (37)	[50·7 (79)]	53·8 (38)	52·2 (55)	[50·8 (84)]	[50·4 (56)]	50·0 (54)	50·0 (57)
NH, *R* or *L*	51·8 (37) *R*	51·5 (79) *L*	—	—	51·6 (84)	51·2 (56) *R*	50·2 (54) *R*	—
NB	23·2 (35)	23·7 (79)	25·0 (38)	24·1 (55)	24·1 (82)	23·1 (56)	25·0 (64)	24·2 (61)
O_1, *R* or *L*	41·2 (35) *R*	—	41·3 (38)	—	—	38·2 (56)	41·6 (56) *R*	—
Schmidt's O_1, *R* or *L*	—	—	—	—	38·6 (84)	—	—	—

TABLE XXII—(*continued*).

Character	*C* Group						*E* Group	
	Basques	Guanche	Copts	Pompeians	Etruscans	French	Predynastic Egyptians (Naqada *A* and *Q*)	Sardinians
O_1', *R* or *L*	39·1 (35) *R*	39·8 (79)	—	39·8 (55)	—	—	39·1 (57)	—
O_2, *R* or *L*	33·6 (35) *R*	32·9 (79)	34·0 (38)	34·1 (55)	32·9 (84)	33·3 (56)	32·2 (57) *R*	—
G_1	47·0 (28)	—	—	—	—	—	52·5 (49)	—
F.V. G_1	—	—	—	—	—	46·6 (56)	—	—
G_1'	43·3 (28)	—	46·4 (36)	—	45·5 (72)	—	48·0 (49)	—
von Luschan's G_1	—	45·1 (59)	—	—	—	—	—	—
G_2	38·0 (18)	41·7 (67)	39·1 (34)	—	40·8 (65)	37·2 (56)	40·7 (48)	—
100 B/L	77·2 (39)	77·4 (83)	77·9 (38)	78·5 (55)	78·6 (83)	[{79·0 (56)}]	{71·8 (88)}	71·5 (70)
100 H'/L	70·5 (39)	70·7 (76)	71·2 (38)	72·2 (50)	{72·9 (80)}	[{71·4 (56)}]	{72·4 (70)}	71·0 (62)
100 H/L	70·2 (37)	—	{71·3 (38)}	—	{73·6 (79)}	[{72·0 (56)}]	{73·8 (71)}	—
100 B/H'	109·9 (39)	{109·7 (79)}	{109·3 (38)}	{108·6 (50)}	{107·7 (80)}	[{110·6 (56)}]	{99·2 (70)}	{101·3 (63)}
100 B/H	110·2 (37)	—	{109·0 (38)}	—	{106·6 (79)}	109·7 (56)	{97·3 (71)}	—
100 $(B-H')/L$	+6·8 (39)	{+6·8 (79)}	{+6·6 (38)}	{+6·2 (50)}	{+5·6 (80)}	[{+7·5 (56)}]	{−0·6 (70)}	{+0·9 (62)}
100 *fmb*/*fml*	85·1 (39)	{85·0 (76)}	—	{85·0 (47)}	85·9 (75)	—	82·9 (70)	—
Oc. I	58·3 (39)	60·6 (79)	59·3 (38)	—	—	—	60·2 (84)	—
100 NB/NH'	44·8 (35)	[{46·7 (79)}]	46·7 (38)	46·0 (55)	[{47·4 (82)}]	[{45·8 (56)}]	{50·0 (54)}	48·6 (57)
100 NB/NH, *R* or *L*	45·2 (35) *R*	46·4 (75) *L*	—	—	46·9 (82)	45·3 (56) *R*	{49·8 (54)} *R*	—
100 O_2/O_1, *R* or *L*	81·9 (34) *R*	—	82·4 (38)	—	—	87·3 (56)	77·4 (56)	—
100 O_2/Schmidt's O_1, *R* or *L*	—	—	—	—	85·2 (84)	—	—	—
100 O_2/O_1', *R* or *L*	86·3 (34)	82·6 (77)	—	85·2 (55)	—	—	{82·4 (57)}	—
100 $G'H/GB$	78·9 (26)	69·5 (71)	{75·5 (37)}	—	75·3 (70)	74·2 (56)	72·7 (52)	—
100 G_2/G_1	81·3 (18)	—	—	—	—	—	{77·5 (48)}	—
100 G_2/G_1'	88·3 (18)	—	84·6 (33)	—	89·2 (55)	—	{84·8 (48)}	—
100 G_2/F.V. G_1	—	—	—	—	—	80·1 (56)	—	—
100 G_2/von Luschan's G_1	—	{92·5 (59)}	—	—	—	—	—	—
$N\angle$	61°·9 (31)	{64°·6 (76)}	—	{64°·4 (50)}	{64°·9 (78)}	—	{65°·5 (46)}	{66°·5 (43)}
$A\angle$	75°·0 (31)	{73°·6 (76)}	—	{73°·1 (50)}	{73°·0 (78)}	—	{73°·3 (46)}	{72°·5 (43)}
$B\angle$	43°·1 (31)	{41°·8 (76)}	—	{42°·5 (50)}	{42°·1 (78)}	—	{41°·2 (46)}	{41°·0 (43)}
Alv. $P\angle$	88°·7 (19)	86°·8 (74)	—	—	—	—	84°·6 (50)	—
Prosth. $P\angle$	—	—	85°·4 (37)	—	—	86°·5 (56)	—	—

TABLE XXIII.

Mean Measurements of D Group Series.

Character	English (Farringdon Street)	English (Whitechapel)	British Iron Age	Anglo-Saxons	British Neolithic	Reihengräber	Swedish Prehistoric	Egyptians (26th—30th Dynasties)
C	1481·5 (86)	1476·9 (72)	—	—	—	1480·2 (68)	1509·0 (31)	1438·9 (753)
L	188·8 (139)	189·1 (137)	187·4 (61)	190·6 (58)	193·7 (53)	189·4 (234)	188·5 (72)	185·3 (895)
B	142·4 (141)	140·7 (135)	141·4 (102)	141·7 (103)	138·9 (128)	139·8 (235)	139·7 (71)	138·9 (896)
H	130·4 (73)	—	—	137·7 (16)	136·3 (7)	136·4 (29)	137·2 (49)	134·1 (884)
H′	129·7 (118)	132·0 (122)	132·9 (77)	136·0 (31)	135·5 (25)	135·6 (97)	133·4 (13)	[133·1 (884)]
LB	100·1 (118)	101·6 (119)	101·6 (67)	104·1 (31)	103·3 (21)	102·6 (89)	103·2 (44)	101·6 (896)
B′	96·8 (152)	98·0 (132)	98·0 (45)	97·3 (59)	98·7 (41)	97·7 (146)	98·0 (69)	94·8 (935)
S	378·8 (128)	377·1 (131)	379·6 (20)	379·8 (64)	389·0 (31)	380·4 (132)	381·2 (51)	371·9 (884)
S_1	129·3 (153)	—	127·6 (20)	129·3 (83)	132·5 (27)	128·7 (148)	128·6 (19)	127·4 (928)
S_2	128·1 (147)	—	129·9 (20)	129·0 (87)	133·9 (26)	130·1 (154)	129·7 (18)	128·5 (908)
S_3	120·6 (135)	—	120·6 (20)	121·7 (71)	123·3 (20)	121·9 (131)	120·9 (13)	115·2 (889)
S_3'	97·3 (132)	—	—	98·5 (37)	—	99·2 (78)	—	97·1 (885)
U	530·0 (126)	524·3 (126)	528·3 (73)	532·0 (73)	536·6 (106)	534·6 (164)	—	518·7 (876)
Glabella *U*	—	—	—	—	—	—	528·6 (61)	—
Q′	309·0 (75)	—	—	316·1 (23)	313·7 (15)	314·5 (78)	320·1 (55)	307·2 (878)
Bregmatic *Q′*	—	307·9 (115)	—	—	308·5 (10)	—	—	—
Broca's *Q*	—	—	303·6 (10)	—	—	—	—	—
fml	36·8 (115)	35·9 (117)	35·8 (11)	37·5 (20)	36·3 (17)	37·6 (33)	—	35·6 (894)
fmb	30·6 (106)	30·3 (112)	—	31·1 (18)	30·4 (7)	31·6 (27)	—	30·0 (905)
G′H	70·5 (82)	70·2 (75)	69·1 (30)	71·7 (22)	70·8 (32)	70·2 (79)	68·6 (40)	70·4 (845)
GL	94·4 (64)	95·9 (73)	96·3 (63)	96·0 (22)	96·8 (16)	98·0 (38)	97·5 (11)	95·0 (832)
GB	91·4 (74)	90·9 (55)	—	95·0 (19)	95·3 (11)	95·4 (14)	95·0 (36)	95·2 (877)
J	131·0 (43)	130·1 (43)	130·6 (55)	133·3 (34)	130·4 (41)	132·2 (71)	129·2 (36)	128·7 (785)
NH′	51·0 (84)	50·3 (76)	50·6 (99)	52·7 (28)	52·0 (21)	52·6 (65)	51·1 (33)	[50·85 (898)]
NH, *R* or *L*	51·8 (86) *R*	51·2 (79)	—	52·2 (22) *R*	50·6 (15)	—	—	51·65 (898) *L*
NB	24·6 (83)	24·3 (70)	23·7 (67)	24·5 (28)	23·6 (34)	24·9 (66)	23·6 (33)	24·4 (893)
O_1, *R* or *L*	42·3 (81) *R*	43·0 (68) *R*	—	41·9 (19) *R*	42·3 (3)	41·5 (29)	40·2 (32)	41·1 (886)
O_1', *R* or *L*	39·8 (81)	40·5 (67)	39·4 (7)	40·3 (16)	40·9 (8)	—	—	—

TABLE XXIII—(*continued*).

Character	English (Farringdon Street)	English (Whitechapel)	British Iron Age	Anglo-Saxons	British Neolithic	Reihengräber	Swedish Prehistoric	Egyptians (26th—30th Dynasties)
O_2, R or L	34·3 (83) R	33·4 (69) R	33·6 (65)	33·6 (29) R	32·6 (27)	32·9 (48)	32·4 (32)	33·7 (888) R
G_1	49·7 (67)	48·3 (69)	—	50·1 (20)	—	—	—	49·7 (817)
G_1'	46·0 (69)	44·7 (69)	—	46·1 (21)	—	—	—	46·3 (821)
Broca's G_1	—	—	—	—	56·7 (6)	—	52·1 (31)	—
G_2	39·3 (53)	39·6 (32)	—	41·3 (27)	40·2 (7)	39·8 (31)	—	38·8 (703)
Broca's G_2	—	—	—	—	—	—	38·5 (33)	—
100 B/L	75·4 (132)	74·3 (131)	74·8 (61)	74·7 (52)	71·1 (48)	{73·8 (234)}	74·0 (71)	75·1 (884)
100 H'/L	68·6 (115)	70·0 (120)	70·8 (51)	71·2 (25)	69·4 (21)	{71·6 (97)}	70·8 (13)	[{71·8 (884)}]
100 H/L	69·3 (71)	—	—	72·6 (15)	70·7 (5)	72·6 (29)	72·7 (50)	72·5 (871)
100 B/H'	109·8 (117)	{106·6 (122)}	106·7 (77)	104·9 (61)	102·4 (23)	{103·1 (97)}	103·6 (13)	[{104·4 (884)}]
100 B/H	109·1 (73)	—	—	102·5 (15)	102·7 (6)	{102·5 (29)}	{101·8 (49)}	103·7 (873)
100 $(B-H')/L$	+6·7 (113)	+4·3 (120)	{+4·5 (61)}	+3·8 (24)	{+1·8 (25)}	{+2·2 (97)}	{+2·6 (13)}	[{+3·1 (884)}]
100 fmb/fml	83·4 (106)	84·5 (112)	—	82·3 (18)	83·7 (5)	{84·0 (27)}	—	84·5 (889)
$Oc.\ I$	58·0 (131)	—	—	58·2 (35)	—	59·5 (68)	—	61·5 (884)
100 NB/NH'	{48·2 (83)}	{48·3 (70)}	47·0 (67)	47·5 (58)	45·2 (19)	{47·3 (65)}	46·3 (32)	[{47·9 (893)}]
100 NB/NH, R or L	47·5 (81) R	47·6 (70)	—	48·1 (19) R	46·5 (13)	—	—	47·3 (881) L
100 O_2/O_1, R or L	81·0 (79) R	77·7 (68) R	—	77·9 (19) R	80·5 (3)	78·3 (29)	80·3 (30)	82·2 (878) R
100 O_2/O_1', R or L	85·9 (79)	{82·5 (67)}	86·0 (7)	83·3 (46)	80·1 (8)	—	—	—
100 $G'H/GB$	77·1 (66)	76·5 (53)	—	75·3 (43)	75·2 (10)	{73·8 (14)}	72·2 (36)	74·1 (823)
100 G_2/G_1	78·8 (46)	{82·0 (32)}	—	81·5 (18)	—	—	—	78·4 (668)
100 G_2/G_1'	{85·4 (53)}	{88·6 (32)}	—	88·2 (19)	—	—	—	{83·9 (703)}
100 Broca's G_2/Broca's G_1	—	—	—	—	—	—	73·6 (30)	—
100 G_2/Broca's G_1	—	—	—	—	70·5 (4)	—	—	—
$N\angle$	64°·2 (64)	65°·2 (69)	64°·5 (28)	62°·1 (16)	64°·9 (14)	{65°·6 (38)}	66°·4 (11)	63°·9 (818)
$A\angle$	73°·3 (64)	73°·4 (69)	75°·0 (28)	75°·5 (16)	74°·7 (14)	{73°·4 (38)}	72°·6 (11)	74°·1 (818)
$B\angle$	42°·5 (64)	41°·4 (69)	40°·5 (28)	42°·4 (16)	40°·4 (14)	{41°·0 (38)}	40°·9 (11)	41°·9 (818)
$Alv.\ P\angle$	85°·9 (65)	86°·1 (63)	—	88°·1 (16)	83°·3 (4)	—	—	85°·8 (795)
$Prosth.\ P\angle$	—	—	—	—	—	84°·6 (38)	84°·8 (30)	—

TABLE XXIV.

Mean Measurements of Additional Series.

	Group	*C*	*L*	*B*	*H*	*H'*
Italians (Siena)	*A*	—	176·0 (50)	141·1 (50)	—	131·4 (50)
Great Russians	„	1425·4 (157)	175·8 (157)	142·65 (157)	—	[131·2 (157)]
Alsatians	*B*	—	182·5 (95)	147·7 (95)	—	130·6 (95)
Bavarians (Waischenfeld)	„	—	176·7 (57)	148·2 (57)	129·9 (56)	[128·9 (56)]
Austrians (Mediaeval) ...	*D*	—	186·8 (52)	140·5 (52)	—	135·1 (30)
Bohemians (Mediaeval) ...	„	—	186·2 (63)	141·9 (63)	—	138·0 (44)
Spanish Bronze Age ...	„	—	183·5 (28)	139·7 (29)	—	134·3 (26)
Maltese	„	—	180·5 (467)	139·0 (468)	—	135·6 (461)
Sicilians	—	1395·0 (106)	180·7 (107)	136·8 (107)	—	132·1 (106)

	Group	*U*	Glabella *U*	Bregmatic *Q'*	Broca's *Q'*	*fml*
Italians (Siena)	*A*	—	—	—	—	—
Great Russians	„	—	513·0 (157)	—	—	35·15 (157)
Alsatians	*B*	—	—	—	—	—
Bavarians (Waischenfeld)	„	528·8 (57)	—	—	—	—
Austrians (Mediaeval) ...	*D*	526·9 (47)	—	317·3 (44)	—	—
Bohemians (Mediaeval) ...	„	—	523·6 (60)	—	316·9 (58)	—
Spanish Bronze Age ...	„	520·7 (27)	—	—	301·3 (26)	35·7 (24)
Maltese	„	—	—	—	—	—
Sicilians	—	507·2 (107)	—	—	300·0 (106)	33·5 (107)

	Group	100 *fmb*/*fml*	*J*	*G'H*	*NH*, *R* or *L*	*NH'*
Great Russians	*A*	84·5 (157)	128·8 (156)	—	—	49·6 (157)
Alsatians	*B*	—	133·0 (95)	70·5 (95)	—	52·1 (95)
Bavarians (Waischenfeld)	„	—	133·0 (29)	70·1 (29)	—	51·2 (30)
Bohemians (Mediaeval) ...	*D*	—	131·5 (45)	68·1 (45)	—	51·3 (45)
Spanish Bronze Age ...	„	85·1 (20)	128·2 (19)	—	—	49·7 (22)
Maltese	„	—	132·3 (263)	68·1 (437)	52·1 (461)	[51·3 (461)]
Sicilians	—	83·5 (107)	—	—	—	49·2 (103)

	Group	O_1', *R* or *L*	Schmidt's O_1, *R* or *L*	O_2, *R* or *L*	100 O_2/O_1, *R* or *L*	100 O_2/O_1', *R* or *L*	100 O_2/Schmidt's O_1, *R* or *L*
Great Russians	*A*	—	38·85 (157)	32·5 (157)	—	—	83·7 (157)
Alsatians	*B*	—	—	—	—	—	—
Bavarians (Waischenfeld)	„	—	—	34·4 (32)	82·7 (32)	—	—
Bohemians (Mediaeval) ...	*D*	—	38·8 (44)	32·4 (45)	—	—	83·7 (44)
Spanish Bronze Age ...	„	40·8 (25)	—	31·4 (26)	—	77·4 (25)	—
Maltese	„	—	—	33·3 (456) *R*	82·3 (451)	—	—
Sicilians	—	36·5 (107)	—	31·6 (107)	—	86·7 (107)	—

TABLE XXIV—(*continued*).

Mean Measurements of Additional Series.

Maximum H	LB	B'	S	S_1	S_2	S_3
—	—	99·4 (50)	{360·5 (50)}	125·9 (50)	124·2 (50)	110·4 (50)
133·9 (157)	99·2 (157)	96·8 (157)	364·8 (157)	127·0 (156)	126·0 (156)	112·2 (156)
—	98·4 (95)	—	—	—	—	—
—	97·9 (56)	—	—	—	—	—
—	—	97·9 (47)	381·0 (31)	—	—	—
—	101·8 (34)	98·0 (62)	379·3 (58)	—	—	—
—	99·4 (25)	96·4 (28)	373·3 (25)	127·7 (27)	126·9 (26)	{117·6 (23)}
—	101·1 (459)	96·6 (467)	—	—	—	—
—	—	93·8 (107)	367·6 (106)	124·3 (106)	130·2 (106)	113·0 (106)

fmb	100 B/L	100 H'/L	100 H/L	100 B/H'	100 B/H	100 $(B-H')/L$
—	80·2 (50)	{74·7 (50)}	—	{107·4 (50)}	—	{+ 5·5 (50)}
29·7 (157)	{81·1 (157)}	[{74·6 (157)}]	—	[{108·7 (157)}]	—	[{+ 6·5 (157)}]
—	80·95 (95)	{71·5 (95)}	—	{113·1 (95)}	—	{+ 9·4 (95)}
—	83·9 (57)	[{72·9 (56)}]	73·5 (56)	[{115·0 (56)}]	{114·1 (56)}	[{+10·9 (56)}]
—	75·3 (52)	72·1 (30)	—	{104·0 (30)}	—	{+ 2·9 (30)}
—	76·9 (63)	74·2 (44)	—	{102·8 (44)}	—	{+ 2·1 (44)}
30·4 (20)	76·2 (28)	73·1 (26)	—	{104·1 (26)}	—	{+ 2·9 (26)}
—	77·1 (463)	75·2 (461)	—	{102·6 (461)}	—	{+ 1·9 (461)}
27·9 (107)	75·6 (107)	{73·1 (106)}	—	{103·6 (106)}	—	{+ 2·6 (106)}

NB	GB	GL	100 NB/NH, R or L	100 NB/NH'	100 $G'H/GB$	O_1, R or L
23·3 (157)	—	96·3 (157)	—	47·1 (157)	—	—
—	92·9 (95)	—	—	—	{75·9 (95)}	—
24·9 (30)	—	—	—	48·7 (30)	—	41·6 (32)
25·2 (45)	97·2 (45)	—	—	49·2 (44)	70·1 (45)	—
24·0 (22)	—	—	—	48·9 (23)	—	—
24·4 (452)	94·6 (420)	96·3 (392)	46·9 (448)	[{47·5 (452)}]	{72·0 (420)}	41·15 (458) R
23·4 (103)	—	—	—	47·6 (103)	—	—

G_1'	Broca's G_1	Ranke's G_1	G_2	Broca's G_2	Ranke's G_2	$N\angle$	$A\angle$	$B\angle$	*Prosth.* $P\angle$
—	—	—	—	—	—	—	—	—	—
45·4 (95)	—	—	—	40·6 (95)	—	—	—	—	—
—	—	44·8 (24)	—	—	39·1 (24)	—	—	—	88°·0 (15)
—	—	—	—	—	—	—	—	—	—
—	50·9 (20)	—	37·8 (20)	—	—	—	—	—	—
—	—	—	36·2 (447)	—	—	{66°·0 (392)}	{73°·6 (392)}	{40°·4 (392)}	—
—	—	—	—	—	—	—	—	—	—

NOTE ON STANDARDISATION OF METHOD OF USING THE COEFFICIENT OF RACIAL LIKENESS.

By KARL PEARSON, F.R.S.

It appears to me after reading Dr Morant's paper, wherein there are a number of new points, that it is more or less possible to improve the discussion of racial affinities by aid of the Coefficient of Racial Likeness. In the first place I must again emphasise two points:

(i) The product terms in the full expression for the coefficient have been neglected; this, as I have previously stated, can hardly be avoided at any rate at present. But it is possible by choosing characters which are not highly correlated to ensure that the neglected product terms are not of very great importance. If among those selected such highly correlated characters have been taken, this is likely to affect the results.

(ii) The influence of personal equation in making craniometric measurements is, I feel convinced, higher than it has been rated, perhaps, by Dr Morant. Notwithstanding various international agreements, there still exist many cases in which the definition of points or the description of measurements is far too vague, and there is no school whose technique is accepted as a standard, where the craniologist might obtain insight into methods of measurement; such a school would be far better than the verbal definitions of text-books or concordats. There are certain customary measurements in which different interpretations of the definitions of the terminal points, or even the use of differing definitions, are likely to introduce divergences as high or higher than racial differences. In the very valuable table which Dr Morant has given of the mean values of the α's* he has found for various characters, I notice several of these equivocal characters such as H', O_1, G_1, and Q' which appear to give high α's. I am by no means certain that they are therefore to be considered as those which are of most value for distinguishing racial differences. Again a high value of α does not necessarily mean that its contribution to the C.R.L. is of great importance. It certainly would be so if those characters with high values of α had low correlations with each other, for then we need pay little attention to the neglected product terms in the coefficient. But if the highly correlated characters are largely those which give the high α's, it does not follow of necessity that they are on this account the characters which will have most influence on the magnitude of the true C.R.L., and so be the best aids in discriminating races. They will, of course, have most influence on the C.R.L. in its *present* form, but that form has only been adopted on the assumption that we are dealing with characters that have *small* correlations with one another. Now I notice in the characters which have in

* See his Table XVI, p. 336.

Dr Morant's table high values of α a number which have correlations ranging from ·4 to ·8 with one another. Hence I do not feel certain that such characters are really best suited to discriminate racial differences; it might even be argued that characters with such high correlations ought *not* to be used at all, so long as the validity of our coefficient as at present depends upon neglect of the correlation terms.

Not unnaturally those who have first used the C.R.L. have felt disinclined to omit such cranial characters as are commonly used to mark racial differences, for example, cranial length, breadth, cephalic index. It may be a suggestion of perfection, but I think a greater attempt should be made to deal only with characters of low mutual correlation in computing the C.R.L. in its present form.

Things being as they are I am inclined to doubt whether it is well to consider any C.R.L. under 3 as marking a distinct racial difference. It is true we reach—as the present issue of *Biometrika* illustrates—quite a number of coefficients of value under 3, but bearing in mind the above remarks I should myself be disinclined to lay any stress on the differentiation of two races having a coefficient less than 3.

I would therefore put forward the following suggestions with regard to a more or less standardised manner of approaching the racial problem by aid of the C.R.L. in its present form. I would first compute the C.R.L.'s for every pair of races in the universe of races under consideration; this would enable me to say whether on the basis of the existing data any two series of skulls are to be considered as racially differentiated. But under existing circumstances I should not feel inclined to accept a coefficient under 3 as marking real racial difference; its value may have arisen from personal equation in the matter of equivocal measurements, or the coefficient may have been emphasised owing to the use of highly correlated characters not justifying the neglect of the product terms. All C.R.L.'s over 3 I would for the present assume to indicate differentiated races. Now we want a method of comparing these significantly different coefficients on a standard, which will to some extent correct the number of crania in the individual series. Knowing how dominating is the racial influence as compared with that of the size of sample, I doubt if the influence of the sizes of n_1 and n_2 would be worth considering if all cranial series numbered something from 50 to 100*. My criticism of Dr Morant's method of dividing up into series of sets for pairs of ranges of n_1 and n_2 is not based on any theoretical objection, but solely on the feeling that it tends to weary the reader who cannot see the whole at a glance, and is by no means economical from the standpoint of an editor-proprietor! Since the influence of the size of n would not I think be of much importance if cranial series were in number between 50 and 100†, I would propose to reduce the C.R.L. in each

* The reader can convince himself of this by comparing the mean values of α at the bottom of each of the columns, 6 to 11, of Table XVI on p. 336 of Morant's paper.

† I am very doubtful whether it is profitable to use series of crania under 50, and it is only exceptional series which run to more than 100. Of course the ideal thing would be to work with 100 crania of the one sex for every race and with identical standard characters, all with low correlations.

case to a standard value of 75 skulls, for those cases in which the C.R.L. exceeds 3. I would retain the $\frac{n_1 n_2}{n_1 + n_2}$ for the separate characters, but multiply the $S(\alpha)$ part of the coefficient by the same function $\frac{\bar{n}_1 + \bar{n}_2}{\bar{n}_1 \bar{n}_2}$ of the mean values of n_1, n_2 inverted and by $\frac{75 \times 75}{75 + 75}$ directly, or together by $37{\cdot}5\ \frac{\bar{n}_1 + \bar{n}_2}{\bar{n}_1 \bar{n}_2}$. This would suffice to reduce all significant coefficients (i.e. those > 3) to about the middle of the range 50 to 100. Then the comparison of all such coefficients might be made by exhibiting them in a single table. We should thus be enabled to see at a glance the relative racial differences of all races for which we had found differentiation on the basis of the unmodified coefficients originally examined. I think some such method would save the time of the reader and the space of the publisher.

A STUDY OF THE SCOTTISH SHORT CIST CRANIA.

By Professor R. W. REID, M.D. and G. M. MORANT, D.Sc.

Almost every county of Scotland has furnished examples of short cist interments. Objects of bronze have been found in several of the graves, but in the majority of cases no metal artifacts were included in the cist. The assumption that all are of Bronze Age date is based on the uniformity of size, the flexed position of the skeletons and the presence of definite pottery types. Small numbers of skulls from short cists are preserved in museums in Scotland and England. All the more reliable measurements of the adult and undistorted specimens that could be collected are given in Appendices I and II below. They include a number of previously unpublished ones taken by Professor R. W. Reid, University of Aberdeen. References to other sources are given on p. 388. The geographical distribution of the 77 specimens dealt with is: Northern Counties 32, Southern Counties 27, Orkneys 14, Hebrides 2, Arran 1 and 1 from an unknown locality. The measurements denoted by index letters in the tables and appendices below are defined on pp. 362—364 of this part of *Biometrika*, with the exception of the following: F = Flower's ophryo-occipital length, OH = vertical height from auricular axis, PH = chord from alveolar point to tip of anterior nasal spine, DC = chord dacryon to dacryon, Palato-max. L = Flower's maxillary length from the alveolar point to "a line drawn across the hinder borders of the maxillary bones" (see *Journal of the Anthropological Institute*, Vol. x. 1880, p. 161), Palato-max. B = Flower's maxillary width "between the outer borders of the alveolar arch immediately above the middle of the second molar tooth," Palato-max. index = 100 Palato-max. B/Palato-max. L. The ♂ and ♀ mean measurements are given in the appendices.

The standard deviations of five characters for the Scottish Short Cist skulls are compared in Table I with the values found for five other series. The Scottish type has the greatest variability in the case of 100 B/L, B and H, and the second greatest in the case of L and U. Several of its standard deviations are significantly greater than those for the other series. It might be suggested that the variability has been appreciably increased owing to the fact that the measurements were taken by a number of different craniologists, and also because several of the specimens which were fragmentary when found had been restored. These two conditions apply with equal force, however, to the British Neolithic, English Bronze Age and Reihengräber series. The evidence suggests that the Short Cist series is more variable than a homogeneous population is expected to be. As the sample is small, no division by statistical methods can be attempted. Judging by the cephalic indices, a finer geographical grouping would not lessen the variability.

The means for all the available ♂ skulls are given in Appendix I. Coefficients of racial likeness with six other British series are shown in Table II. The Short Cist

skulls have a moderately low coefficient with the modern Eastern Scottish, but they are clearly differentiated from the Lowland Scottish. The selected English Bronze Age type shows a close resemblance to the supposed contemporary Scottish one, but the two are by no means identical. It is clear that the resemblance would be less close if the unselected English Bronze Age series were to be compared with the Short Cist

TABLE I.

Standard Deviations of Scottish Short Cist and other Series. Male Skulls.*

Character	Scottish Short Cist	British Neolithic	English Bronze Age Type	Swedish Prehistoric	Reihengräber	Farringdon Street English (17th Century)
$100\,B/L$	4·74 ± ·37 37	3·02 ± ·13† 116	3·14 ± ·16† 89	4·04 ± ·23 71	3·35 ± ·11 220	3·48 ± ·14 132
L	6·41 ± ·46 44	6·36 ± ·28‡ 116	5·88 ± ·30‡ 90	6·21 ± ·35 72	6·31 ± ·20 222	6·46 ± ·26 139
B	7·21 ± ·54 41	4·65 ± ·16 128	6·67 ± ·34 89	5·71 ± ·32 71	5·54 ± ·18 225	5·90 ± ·24 141
H'	6·04 ± ·49 35	— —	— —	5·06 ± ·34§ 49	5·83 ± ·31 80	5·06 ± ·22 118
U	16·09 ± 1·38 31	14·46 ± ·67 106	17·72 ± ·93 82	13·91 ± ·85 61	15·65 ± ·58 164	15·92 ± ·68 126

* References to the series considered in this table, other than the Scottish Short Cist, are given on pp. 356—361 of this part of *Biometrika*, and the means are in Tables XXI (p. 368) and XXIII (p. 372). The English Bronze Age type was found by subtracting from the total sample of skulls of Bronze Age date those which were thought to be of the Neolithic or hybridised type (see *Biometrika*, Vol. XVIII. 1926, pp. 61—64). The other samples were unselected.

† These standard deviations are for $100\,B/F$ in place of $100\,B/L$.

‡ These standard deviations are for F in place of L.

§ This standard deviation is for H in place of H'.

one*. The latter is in marked contrast with the Neolithic type and it is also distinctly removed from the English ones of later than Bronze Age date. Coefficients of racial likeness were computed between the Scottish Short Cist and the most similar continental series which could be found, comparison being restricted to those made up of forty or more skulls. All the coefficients less than 5 which were found are given in Table III. It will be seen that both Czechs and Finns resemble the Short Cist type rather more closely than the selected English Bronze Age type does. Several of the series which are grouped together by having low coefficients with the

* The mean index $100\,B/F$ for all available English ♂ skulls of Bronze Age date is 78·9 (151) ($\sigma = 5·42 \pm ·21$). After the supposed Neolithic element is removed that becomes {82·0 (89)}, and for the ♂ Scottish Short Cist skulls the index is {82·6 (32)}.

Scottish one are not very closely related to one another, and it is clear that more adequate evidence will be needed to determine the racial relationships of the Short Cist population.

All the α's greater than 15 which were found in computing the coefficients are given in Tables II and III. The divergence of the lower four series in Table II is

TABLE II.

Coefficients of Racial Likeness between the Scottish Short Cist and other British Series. Male Skulls.

	Scottish Short Cist (22·6) and		α's > 15							
	All Characters	Indices and Angles	$100\frac{B}{L}$	L	B	$100\frac{H'}{L}$	$100\frac{B}{H'}$	LB	H'	$G'H$
English Bronze Age† (28·2)	2·40 ± ·19 [23]*	0·70 ± ·30 [9]	—	—	—	—	—	15·8	—	—
Eastern Scottish‡ (20·7)	4·30 ± ·20 [22]	6·01 ± ·33 [7]	—	—	—	28·0	—	—	18·2	15·4
Lowland Scottish‡ (48·0)	11·02 ± ·20 [22]	18·74 ± ·33 [7]	79·0	37·7	23·3	38·6	—	—	—	—
Anglo-Saxons† (36·4)	11·05 ± ·19 [24]	13·86 ± ·29 [10]	92·6	58·2	33·5	23·4	—	26·5	—	—
Farringdon Street English† (95·4)	14·60 ± ·19 [25]	22·65 ± ·29 [10]	100·9	51·9	28·6	114·7	—	—	47·4	—
British Neolithic† (30·1)	21·40 ± ·19 [23]	30·15 ± ·30 [9]	201·4	96·7	73·9	43·5	21·3	16·2	—	—

* The numbers in square brackets are the numbers of characters on which the coefficients are based.

† References to these series are given on pp. 356—7 of this part of *Biometrika*, and the means are in Tables XXI (p. 368) and XXIII (p. 370).

‡ The means of these modern Scottish series (first given in *Biometrika*, Vol. xviii. 1926, p. 38) were reduced from measurements given by Sir William Turner (A Contribution to the Craniology of the People of Scotland. Part I. Anatomical. *Transactions of the Royal Society of Edinburgh*, Vol. xl. 1901—1905, pp. 547—613). The Lowland Scottish series was made up by pooling Turner's Mid-Lothian, Renfrew, Practical Rooms, Lowlands and Highlands and Hebrides groups. The Eastern Scottish series comprises his Fifeshire, East Lothian and North-East Counties groups. See *Biometrika*, Vol. xviii. 1926, p. 22.

due primarily to their lower cephalic indices. The Short Cist type differs from most of the series with which it has shown the lowest coefficients by having high values for the characters H', $100\,H'/LO_1$ and low values for $100\,O_2/O_1$, LB and $G'H$.

Transverse, horizontal and sagittal contours were constructed by the method first used by Benington* and since modified by workers in the Biometric Laboratory†. Male skulls only were used. The contours of eleven skulls in the Anthropological

* Cranial Type Contours. *Biometrika*, Vol. viii. 1911, pp. 123—201.

† See *Biometrika*, Vol. xiv. 1923, pp. 227—252.

TABLE III.

Coefficients of Racial Likeness between the Scottish Short Cist and other European Series. Male Skulls.

	Scottish Short Cist (22·6) and		a's > 15							
	All Characters	Indices and Angles	$100\frac{B}{L}$	B	S	O_1	$100\frac{O_2}{O_1}$	LB	$G'H$	L
Czechs (Matieka)† (69·7)	2·13 ± ·19 [23]	1·74 ± ·30 [9]	—	—	—	—	—	—	—	—
Finns‡ (113·8) ...	2·14 ± ·20 [22]	1·90 ± ·36 [6]	—	—	—	—	—	—	—	—
Rumanians* (40·0) ...	2·78 ± ·20 [21]	1·44 ± ·30 [9]	—	—	18·0	—	—	—	—	—
Dutch (Saaftingen)§ (50·5)	3·44 ± ·21 [20]	5·97 ± ·36 [6]	26·4	18·3	15·8	—	—	—	—	—
Swiss (Daniser)‖ (37·5)	3·66 ± ·19 [23]	4·71 ± ·32 [8]	18·6	—	20·8	—	—	—	—	—
Etruscans* (79·6) ...	3·71 ± ·20 [22]	5·24 ± ·32 [8]	23·0	—	—	—	—	—	—	—
Serbo-Croats* (79·8)	3·90 ± ·19 [24]	4·38 ± ·29 [10]	—	—	—	—	—	16·6	—	19·8
Bavarians (Alt-bayerisch)* (79·0)	4·67 ± ·20 [21]	4·14 ± ·33 [7]	—	—	15·5	44·2	21·4	—	—	—
Greeks* (89·7) ...	4·70 ± ·19 [24]	4·59 ± ·29 [10]	—	19·8	—	—	—	—	18·3	—

* References to these series are given in the present part of *Biometrika* on pp. 356, 357 and 360. The means are in Tables XX (p. 366), XXI (p. 368) and XXII (p. 370).

† Crânes et ossements des anciens cimetières de la villa Prague. *Anthropologie* (Praha), Vol. II. 1924, pp. 183—210.

‡ Unpublished pooled means derived mainly from K. Hällsten's catalogues (Matériaux pour servir à la connaissance des crânes des peuples Finnois) published in *Bidrag till Kännedom af Finlands Natur och Folk, utgifna af Finska Vetenskaps-Societeten* between 1881 and 1887.

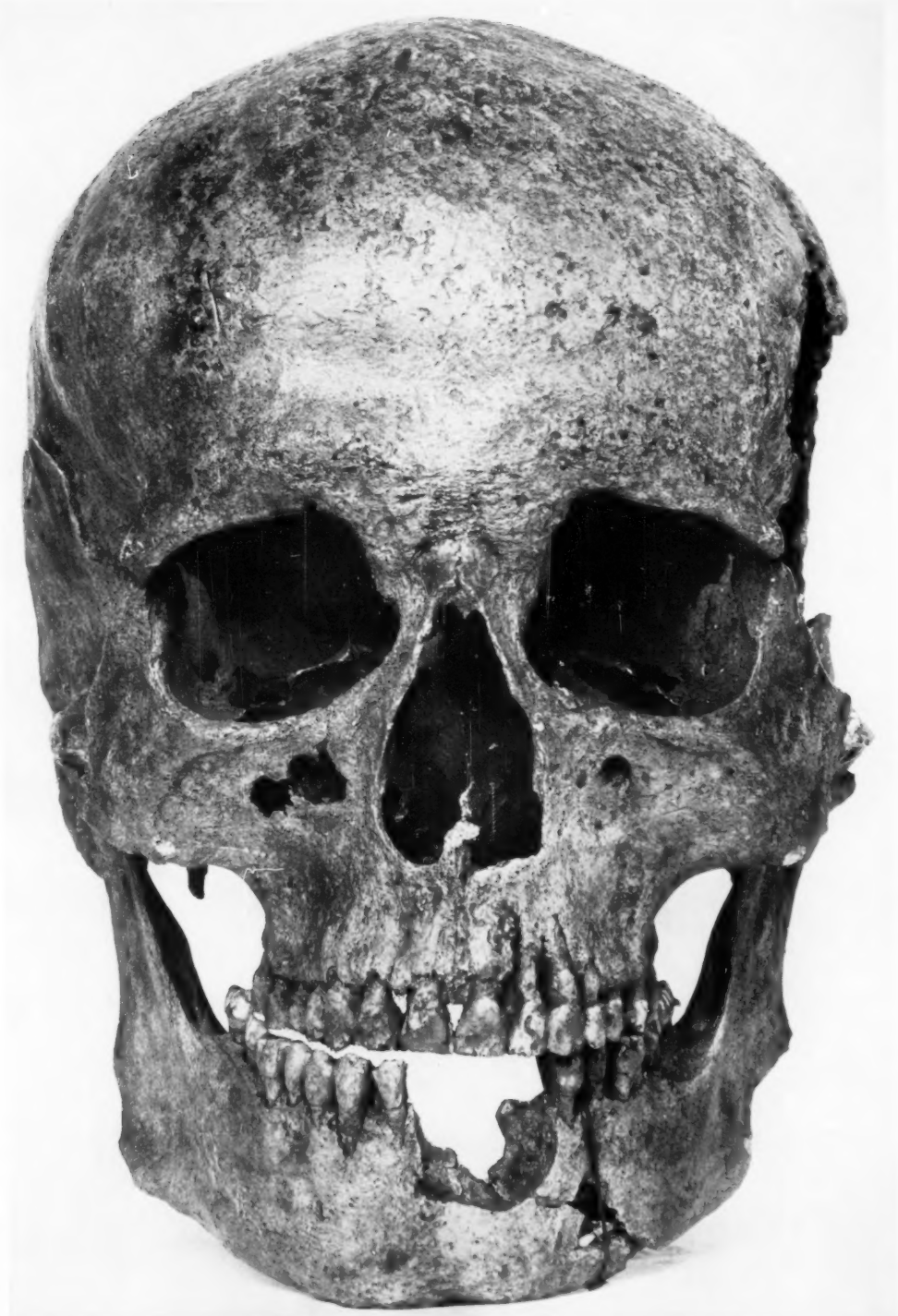
§ L. de Pauw and V. Jacques: Le cimetière de Saaftingen. *Bulletin de la Société d'anthropologie de Bruxelles*, T. III. 1884—1885. These skulls are probably of mediaeval date.

‖ Reicher: Untersuchungen über die Schädelform der alpenländischen und mongolischen Brachycephalen. *Zeitschrift für Morphologie und Anthropologie*, Bd. XV. 1913, pp. 421—562.

Museum, University of Aberdeen, were drawn by Professor R. W. Reid * and those of four in the Anatomy Museum, University of Edinburgh, were made under the direction of Professor A. Robinson †.

* These skulls are Nos. 1, 2, 3, 4, 6, 8, 9, 10, 11, 12, 13 in Appendix I.

† Nos. 16, 17, 22 and 23 in Appendix I.



Skull of Adult Male from Short Stone Cist, No. 1. Found at Castle Hill, Boyndlie, Tyrie, Aberdeenshire. *Norma facialis.* Natural size.

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Skull of Adult Male from Short Stone Cist, No. 1. Found at Castle Hill, Boyndlie, Tyrie, Aberdeenshire. *Norma lateralis* (Right Profile). $\frac{1}{3}$ linear.

Skull of Adult Male from Short Stone Cist, No. 1. Found at Castle Hill, Boyndlie, Tyrie, Aberdeenshire. *Norma occipitalis.* Natural size.

Skull of Adult Male from Short Stone Cist, No. 1. Found at Castle Hill, Boyndlie, Tyrie, Aberdeenshire. *Norma verticalis.* Natural size.

Skull of Adult Male from Short Stone Cist, No. 1. Found at Castle Hill, Boyndlie, Tyrie, Aberdeenshire. *Norma basalis.* Natural size.

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Skull of Adult Male from Short Stone Cist, No. 4. Found at Parkhill, Newmachar, Aberdeenshire.
Norma facialis. Natural size.

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Skull of Adult Male from Short Stone Cist, No. 4. Found at Parkhill, Newmachar, Aberdeenshire. *Norma lateralis* (Right Profile). $\frac{1}{2}$ linear.

Skull of Adult Male from Short Stone Cist, No. 4. Found at Parkhill, Newmachar, Aberdeenshire.
Norma occipitalis. Natural size.

Skull of Adult Male from Short Stone Cist, No. 4. Found at Parkhill, Newmachar, Aberdeenshire.
Norma verticalis. Natural size.

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Skull of Adult Male from Short Stone Cist, No. 12. Found at Upper Mains of Catterline, Kinneff, Kincardineshire. *Norma lateralis* (Right Profile). $\frac{1}{2}$ linear.

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The mean measurements are given in Tables IV—VI and the types constructed from these means are Figs. I—III. These are the first type contours to be prepared of a European racial series having a mean cephalic index greater than eighty, but larger numbers will be required to determine the outlines accurately.

TABLE IV.

Mean Values of Scottish Short Cist Male Transverse Contours.*

	MA	*1*	$M\frac{1}{4}$	*2*	*3*	*4*	*5*
R ...	116·1 (13)	61·1 (13)	63·9 (13)	65·4 (11)	69·0 (10)	72·0 (11)	72·8 (11)
L ...		61·1 (13)	63·8 (10)	65·6 (10)	69·3 (10)	71·4 (9)	71·4 (9)

	6	*7*	*8*	*9*	*10*	$A\frac{1}{4}$
R ...	72·4 (11)	70·2 (12)	65·6 (12)	56·6 (12)	41·4 (12)	20·4 (13)
L ...	70·6 (9)	68·9 (9)	64·2 (10)	55·1 (11)	40·0 (11)	18·9 (11)

* The points usually shown where the section crosses the extension of the zygomatic ridges had not been marked on these individual contours.

TABLE V.

Mean Values of Scottish Short Cist Male Horizontal Contours†.

	FO	$F\frac{1}{4}$	$F\frac{1}{2}$	*2*	$2\frac{1}{2}$	*3*	*4*
R ...	175·7 (10)	24·3 (9)	37·7 (9)	50·0 (9)	49·4 (9)	50·6 (9)	58·6 (9)
L ...		26·7 (10)	37·6 (10)	49·3 (10)	48·5 (9)	50·2 (8)	56·1 (6)

	5	*6*	*7*	*8*	*9*	*10*	$O\frac{1}{4}$
R ...	66·8 (9)	71·2 (9)	72·3 (9)	69·9 (9)	63·1 (10)	47·3 (10)	27·7 (10)
L ...	63·7 (7)	69·0 (7)	71·4 (7)	69·1 (8)	61·7 (7)	46·8 (7)	27·0 (7)

† The points usually shown where the section crosses the temporal lines had not been marked on these individual contours.

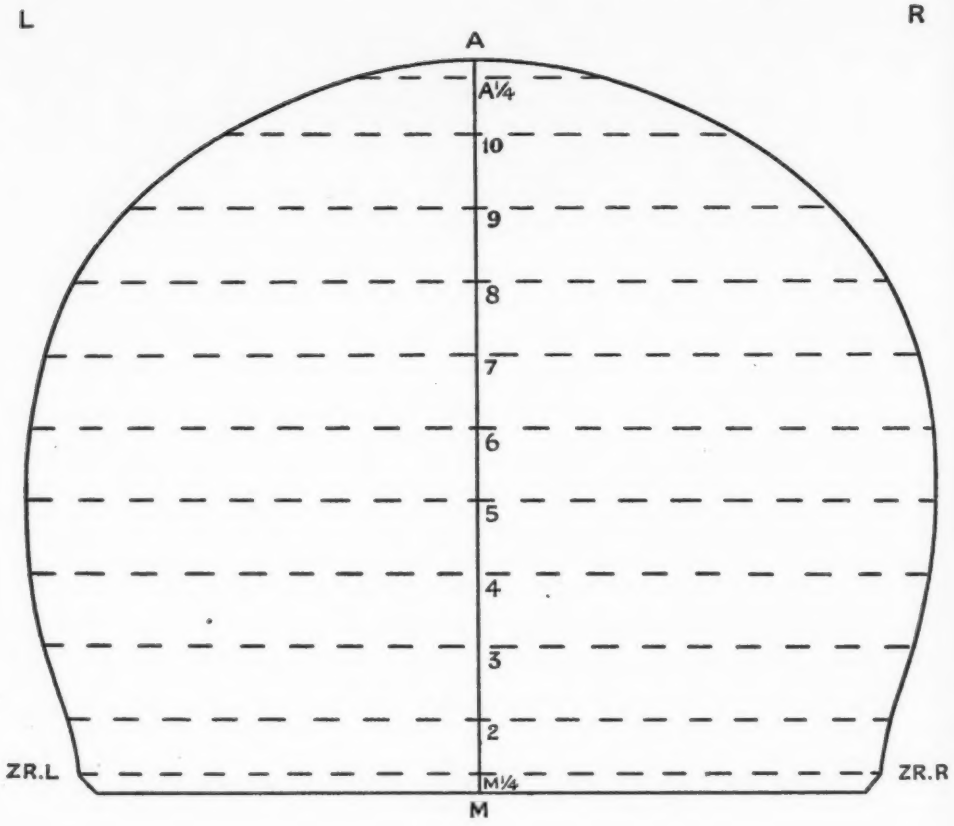

Fig. I Short Cist Skulls (Scotland). ♂ Transverse Type Contour.

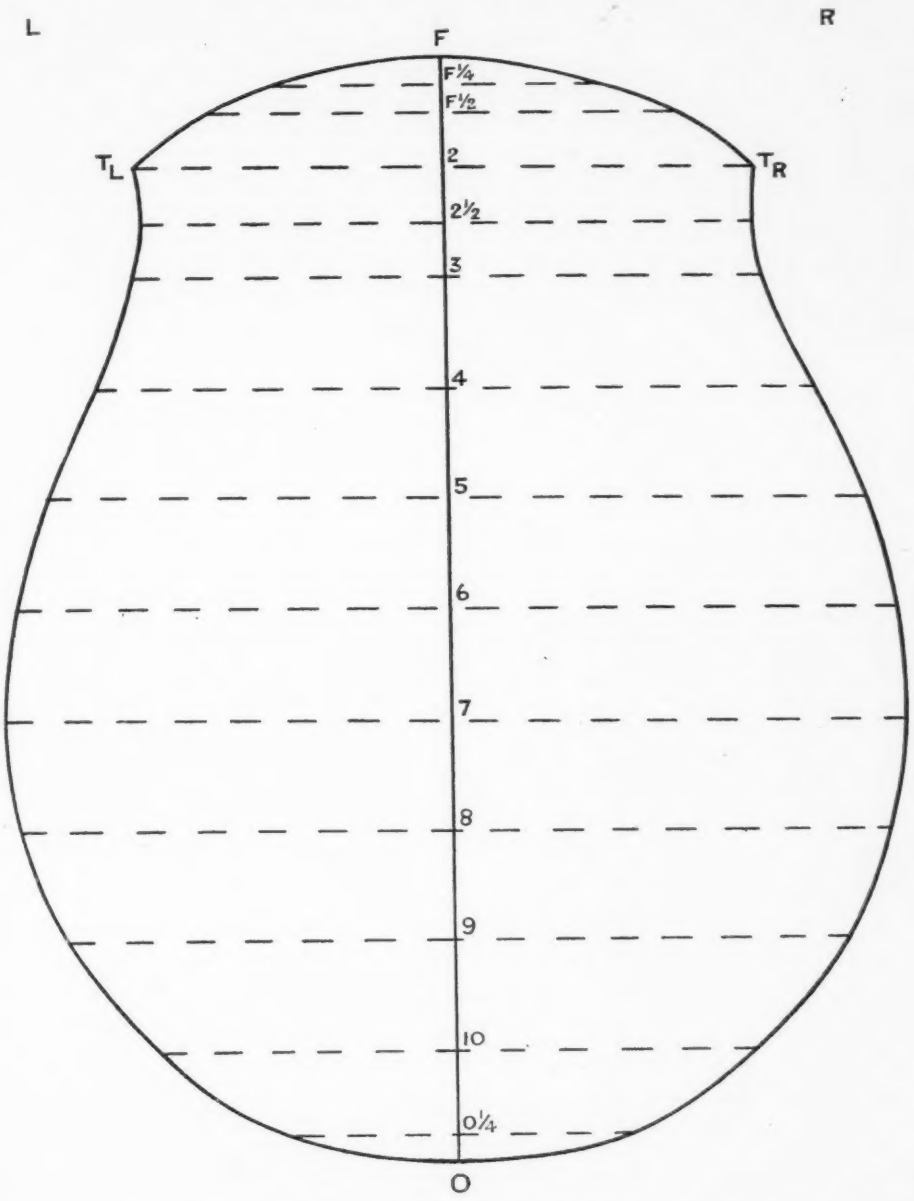

Fig. II Short Cist Skulls (Scotland). ♂ Horizontal Type Contour.

TABLE VI.

Mean Values of Scottish Short Cist Male Sagittal Contours.

$N\gamma$	Ordinates above $N\gamma$								
	$0=N$	$N\frac{1}{4}$	1	2	3	4	5	6	7
174·2 (14)	26·2 (13)	41·7 (14)	62·0 (14)	76·3 (14)	83·9 (14)	88·2 (14)	89·7 (14)	89·1 (14)	85·1 (14)

Ordinates above $N\gamma$				Ordinates below $N\gamma$					
8	9	$\gamma\frac{1}{4}$	$\gamma\frac{1}{2}$	$N\frac{1}{4}$	1	2	8	9	$\gamma\frac{1}{2}$
76·2 (14)	58·0 (14)	30·6 (12)	22·1 (11)	61·6 (11)	56·0 (12)	53·1 (10)	48·9 (11)	39·5 (12)	31·5 (12)

Ordinates below $N\gamma$	Vertex		Bregma		Glabella		Occipital Point	
$\gamma\frac{1}{4}$	x from N	y	x from N	y	x from N	y	x from γ	y
25·4 (12)	94·4 (14)	90·1 (14)	72·5 (14)	88·3 (14)	3·9 (13)	10·5 (13)	0·7 (11)	2·8 (11)*

λ		Sub-Orbital		Auricular Point		Opisthion		Inion	
x from γ	y	x from N	y	x from γ	y	x from γ	y	x from γ	y
6·5 (13)	31·8 (13)	9·1 (13)	25·5 (13)	84·2 (14)	25·7 (14)	51·7 (11)	52·9 (11)	6·4 (12)	29·1 (12)

Basion		Alveolar Point		Nasal Bones			Palate	
							P'	
From γ	From N	From N	From Bas.	(i)	(ii)	(iii)	x from N	y
99·4 (8)	99·0 (8)	66·8 (6)	92·2 (6)	0·9 (11)	2·0 (9)	5·3 (5)	45·5 (9)	51·8 (9)

Palate		Frontal Max. Sub. to $N\beta$		Occipital Max. Sub to λ Op.		Max. Sub. to $N\lambda$		Max. Sub. to GI	
P									
x from Alv.	y	x from N	y	x from λ	y	x from N	y	x from G	y
33·1 (8)	13·8 (8)	54·6 (14)	26·4 (14)	56·4 (9)	29·4 (9)	81·3 (13)	74·1 (13)	96·9 (11)	102·8 (11)

Spheno-basion		Sub. from $\frac{1}{2}$ Bas. to Sp. Chord		N.S.		Max. Sub. of Alv. to N.S. Chord	
x from N	y	x from Bas.	y	x from N	y	x from N	y
64·6 (6)	30·4 (6)	13·9 (4)	2·1 (4)	3·2 (12)	49·2 (12)	1·5 (12)	53·8 (12)

* The occipital point is above the $N\gamma$ line.

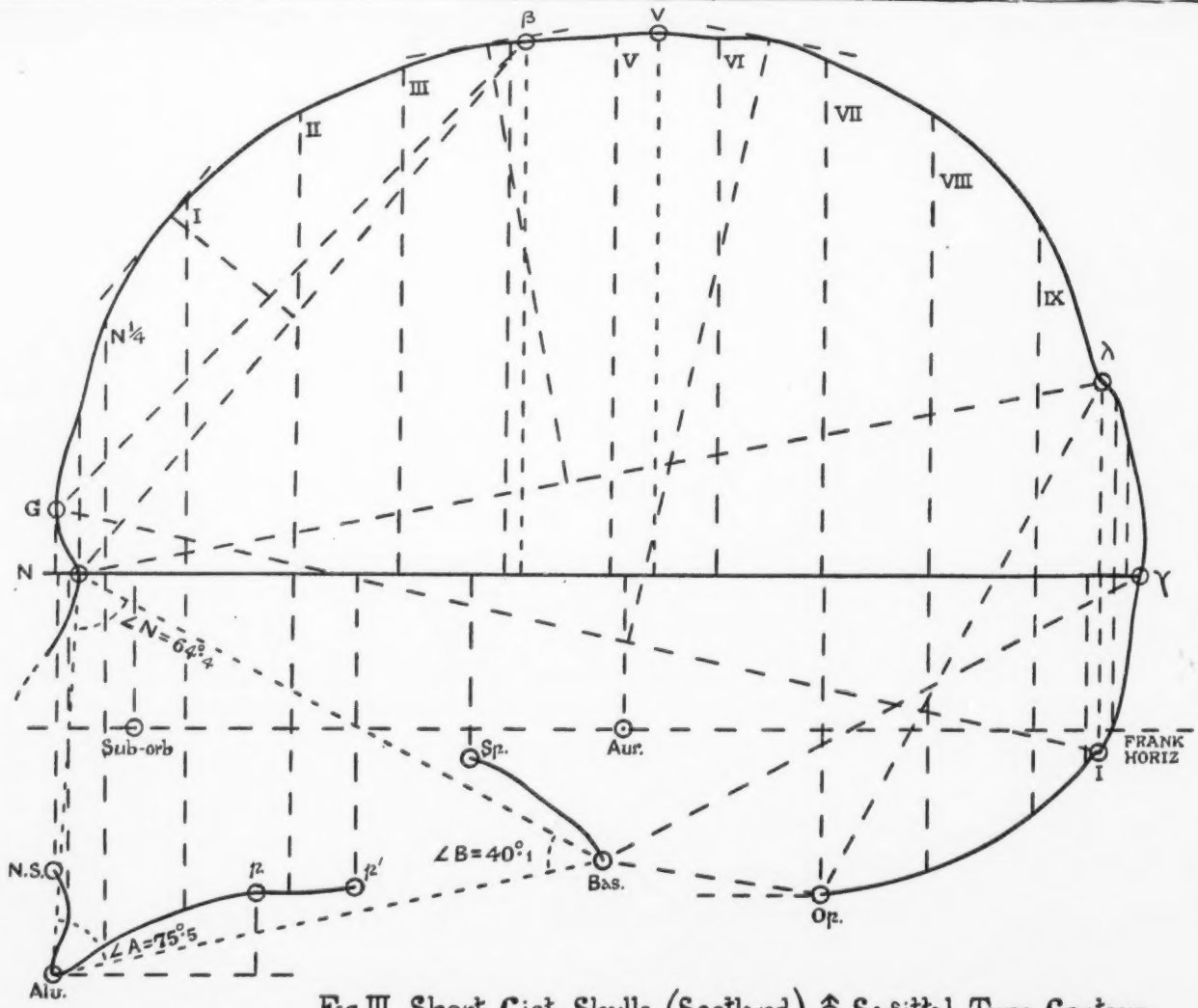

Fig. III Short Cist Skulls (Scotland). ♂ Sagittal Type Contour.

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No.	Locality	When found	Collection
1	Tyrie (Castle Hill), Aberdeenshire	1872	University of Aberdeen
2	Ellon "	1913	" "
3	Persley Quarry "	1868	" "
4	Parkhill "	1867	" "
5	" "	1881	" "
6	Stoneywood "	1866	" "
7	Clinterty "	1897	" "
8	Whitestone, Skene "	1905	" "
9	Mains of Leslie "	1906	" "
10	Auchindoir "	1856	" "
11	Ardoe, Banchory-Devenick, Kincardineshire ...	1871	" "
12	Kinneff, Kincardineshire	1923	" "
13	Tyrie (Blackhills), Aberdeenshire	1908	" "
14	Threipland Farm, Elginshire	1869	University of Edinburgh
15	Leith, Mid-Lothian	1884	" "
16	" "	1884	" "
17	Preston Grange, Mid-Lothian	1887	" "
18	Cranston "	1886	" "
19	Musselburgh "	1896	" "
20	Bridgeness, West Lothian	1896	" "
21	Tranent, East Lothian	1884	" "
22	Inveresk, Kirk Park, East Lothian	—	" "
23	No locality	—	" "
24	Lesmurdie, Banffshire	1851	Museum of Soc. Antiquaries, Edin.
25	Inverurie, Aberdeenshire	1867?	" " "
26	Duns, Berwickshire	1863	" " "
27	Silver Moor, Lanarkshire	1847	" " "
28	West Watten, Caithness-shire	1904	University of Glasgow
29	Boarshills, Fifeshire	1927	University of St Andrews
30	Island of Bernera, Hebrides	1861	Royal Coll. of Surgeons, Eng.
31	Tyrie, Aberdeenshire	1908	University of Aberdeen
32	Montrose, Forfarshire	—	— — —
33	Cavers, Roxburghshire	1896	— — —
34	Carstairs, Lanarkshire	—	— — —
35	Fyrish, Ross-shire	1865	— — —
36	Juniper Green, Mid-Lothian	1851	— — —
37	Pomona, Orkney Islands	—	— — —
38	Tormore, Arran	1861	Museum of Soc. Antiquaries, Edin.
39	Largs, Ayrshire	—	— — —
40	Cockenzie, East Lothian	—	— — —
41	Ratho, West Lothian	—	— — —
42	Cousland, Mid-Lothian	1886	— — —
43	" "	1886	— — —
44	Inveresk, Bellfield, East Lothian	—	— — —
45	Newbigging, Pomona, Orkney Islands	—	Royal Coll. of Surgeons, Eng.
46	Benbecula, Hebrides	—	— — —
47	Knowe of Saverough, Pomona, Orkney Islands	—	Cambridge Museum of Anatomy
48	" " " "	—	" " "
49	" " " "	—	Philosophical Soc., Leeds
50	" " " "	—	Museum of Soc. Antiquaries, Edin.
51	Stonelaws, East Lothian	—	— — —

	Measurements given by	Sex	*C*	*F*	*L*	*B*	*B'*	*H*	*H'*	*OH*	*LB*	Broca's transverse arc	*S*	*S*
	Reid and Low	♂	1530	183	185	150	—	143	143	—	105	310	386	13
	Reid	♂	—	—	—	146	—	—	—	—	—	—	—	13
	Reid and Low	♂	1500	181	185	160	—	144	146	—	97	336	402	13
	" "	♂	1450	176	180	153	—	—	135	—	104	327	360	13
	" "	♂	—	182	184	160	—	—	148	—	100	—	—	13
	" "	♂	1420	168	169	156	—	132	134	—	94	300	361	13
	" "	♂	—	180	185	156	—	—	138	119	98	336	393	14
	" "	♂	1450	—	181	156	—	133	134	124	97	324	375	13
	" "	♂	1460	176	177	154	—	135	136	114	97	332	386	13
	" "	♂	1350	160	167	142	—	136	136	116	100	306	—	13
	" "	♂	—	182	183	153	—	—	135	—	—	330	380	13
	Reid	♂	1600	184	184	—	—	—	—	—	—	—	380	13
	Reid, Turner	♂	—	—	189	158	—	—	143	—	100	330	385	13
	" "	♂	—	176	178	—	104	128	133	104	100	—	366	13
	" "	♂	—	166	162	147	—	—	—	—	—	—	—	-
	" "	♂	1380	182	182	138	—	131	130	—	93	—	—	-
	" "	♂	1490	184	189	134	—	140	142	111	101	298	388	13
	Reid	♂	—	—	—	—	—	—	—	—	—	—	—	-
	"	♂	—	179	180	—	—	—	—	121	85	—	—	-
	Reid, Turner	♂	—	179	185	139	—	—	—	—	—	312	—	13
	" "	♂	—	181	182	148	—	—	—	—	—	323	—	13
	" "	♂	—	179	179	140	—	—	130	113	91	299	376	13
	Reid	♂	—	176	177	133	—	128	127	—	99	—	—	-
Edin.	Reid, Turner	♂	—	184	187	160	—	131	131	111	100	—	370	13
	" "	♂	1500	181	190	150	—	139	140	128	—	—	—	-
	" "	♂♀	—	—	166	137	—	—	—	—	96	—	343	1
	Reid	♂	—	175	—	—	—	—	—	118	—	—	—	-
	Reid, Turner	♂	1425	171	175	150	—	137	138	117	100	314	361	1
	Reid	♂	—	171	172	—	—	137	134	—	104	—	—	-
	Reid, Barnard Davis	♂	—	188	189	143	—	121	121	114	96	—	384	1
	Reid	♂	—	—	189	—	—	—	—	—	—	—	—	-
	Turner	♂	—	—	180	157	—	—	141	—	—	—	—	-
	"	♂	—	—	181	145	—	—	131	—	—	312	—	-
	"	♂	—	—	176	—	—	—	134	—	104	—	354	1
	"	♂	1555	—	186	153	—	—	132	—	100	324	388	1
	"	♂	—	—	178	148	—	—	130	—	95	309	368	1
	"	♂♀	—	—	180	145	—	—	—	—	—	—	—	-
Edin.	Turner, Bryce	♂	—	—	175	143	—	—	—	—	—	—	—	1
	Turner	♂	—	—	175	148	—	—	138	—	—	—	—	-
	"	♂	—	—	180	133	—	—	126	—	99	—	350	1
	"	♂	—	—	177	153	—	—	142	—	—	—	—	-
	"	♂♀	—	—	—	—	—	—	—	—	—	—	—	1
	"	♂	—	—	—	146	—	—	—	—	—	—	—	1
	"	♂	—	—	180	—	—	—	141	—	91	—	386	1
	Garson, Barnard Davis	♂	1570	181	186	148	101	—	142	—	100	—	392	1
	Barnard Davis	♂	—	183	—	152	—	—	—	—	—	—	394	1
y	Garson, also Davis and Thurnam	♂	1630	193	193	149	103	—	136	—	100	—	388	1
	" " "	♂	1472	183	186	145	—	—	142	—	—	—	376	1
	" " "	♂	1571	188	190	148	—	—	142	—	—	—	395	1
din.	" " "	♂	1512	176	179	145	—	—	144	—	—	—	368	1
	Davis and Thurnam	♂	—	185	—	145	—	—	—	—	—	—	384	1
	Mean ...	—	1492·5	179·2	180·8	148·0	102·7	134·3	136·4	116·2	98·1	317·9	377·2	1
	No. ...	—	18	32	44	41	3	15	35	13	28	18	29	

N.B. When the same skull has been measured by Turner and by Reid, the m

APPENDIX I.

Individual Measurements of Male Adult Scottish Short Cist Skulls.

a's erse e	*S*	S_1	S_2	S_3	S_3'	*U*	*fml*	*fmb*	*G'H*	*GL*	*GB*	*J*	*PH*	*NH,R*	*NH'*	*NB*	O_1'	O_1	O_2
0	386	130	142	124	101	548	38	32	72	94	101	137	21?	52	53	26	39	42	30
-	—	125	—	—	—	—	—	—	67	—	93	—	17?	54	—	30	44	47	35
6	402	135	138	129	104	540	39	34	67	87	—	140	—	48	48	24	43	46	34
7	360	135	125	100	—	524	36	—	63	98	—	142	—	48	48	23	41	44	33
.	—	132	118	—	—	—	—	—	70	92	—	—	—	—	53	25	—	—	—
0	361	130	120	111	94	510	37	—	64	87	—	126	—	46	48	25	39	39	30
6	393	143	140	110	—	528	37	—	—	—	—	—	—	—	55	28	—	—	—
4	375	130	132	113	—	512	39	—	72	99	—	134	22?	48	51	26	40	43	32
2	386	132	132	122	101	522	29	26	64	94	—	132	—	48	48	26	40	43	30
6	—	123	122	—	—	494	—	—	64	97	—	136	19?	50	50	24	40	43	31
0	380	130	130	120	—	532	—	—	—	—	—	—	—	—	—	—	—	—	—
-	380	123	115	142	112	—	—	—	—	—	—	—	—	—	—	—	39	42	36
0	385	130	130	125	—	524	41	—	70	95	—	130	15?	50	49	23	44	45	34
-	366	124	126	116	—	—	34	—	—	—	89	—	—	—	51	24	40	—	35
-	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
-	—	—	—	—	—	—	—	—	—	87	91	121	—	48	—	24	39	—	37
8	388	134	140	114	—	518	35	—	69	97	89	125	—	52	49	25	38	—	33
-	—	—	—	—	—	—	—	—	—	—	—	—	—	57	—	25	40	—	39
-	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2	—	130	128	—	—	525	—	—	71	—	—	133	29?	52	55	—	40	—	32
3	—	130	128	—	—	524	—	—	—	—	—	—	—	—	—	—	—	—	—
9	376	132	116	128	—	504	32	—	65	87	97	128	20?	49	48	26	40	—	36
-	—	—	—	—	—	—	—	—	—	—	73	132	—	51	—	23	37	—	37
-	370	130	124	116	—	546	39	—	63	94	111	—	19?	48	50	24	44	—	33
-	—	—	127	117	—	546	—	—	—	—	109	—	—	—	—	—	—	—	—
-	343	119	118	106	—	492	37	—	—	—	—	—	—	—	—	—	—	—	—
-	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4	361	128	120	113	—	512	35	—	69	88	110	146	24?	48	49	25	38	—	32
-	—	—	—	—	—	—	—	—	60	100	—	—	17?	50	—	27	—	—	—
-	384	127	130	127	—	531	—	—	—	—	—	—	—	—	—	—	—	—	—
-	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
-	—	—	—	—	—	534	—	—	—	—	—	—	—	—	—	—	—	—	—
2	—	—	125	116	—	524	36	—	—	—	—	—	—	—	—	—	—	—	—
-	354	118	130	106	—	—	38	—	—	—	—	—	—	—	—	—	—	—	—
4	388	131	132	125	—	538	32	—	65	90	—	—	—	—	52	23	39	—	34
9	368	128	124	116	—	—	33	—	71	89	—	—	—	—	56	20	40	—	32
-	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
-	—	122	127	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
-	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
-	350	119	108	123	—	504	40	—	—	—	—	—	—	—	—	—	—	—	—
-	—	—	—	—	—	508	—	—	—	—	—	—	—	—	—	—	—	—	—
-	—	126	140	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
-	—	120	134	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
-	386	140	130	116	—	—	35	—	—	—	—	—	—	—	—	—	—	—	—
-	392	125	145	122	—	532	36	29	—	100	—	136	—	—	51	25	38	—	29
-	394	124	140	130	—	551	—	—	—	—	—	—	—	—	—	—	—	—	—
-	388	137	127	124	—	548	39	33	—	93	—	140	—	—	57	23	39	—	35
-	376	137	122	117	—	520	—	—	—	—	—	135	—	—	—	—	—	—	—
-	395	134	142	119	—	541	—	—	—	—	—	140	—	—	—	—	—	—	—
-	368	122	132	114	—	510	—	—	—	—	—	132	—	—	—	—	—	—	—
-	384	127	130	127	—	533	—	—	—	—	—	132	—	—	—	—	—	—	—
7·9	377·2	128·7	128·7	119·0	102·4	525·0	36·2	30·8	66·9	93·1	96·3	133·9	20·3	49·9	51·1	24·8	40·0	43·4	33·4
18	29	37	38	31	5	31	22	5	18	19	10	20	10	18	20	24	23	10	23

d by Reid, the measurements and sexing of the latter have been taken, except in the few cases where Turner gives measurements not provided by

O_1	O_2	DC	Palato-max. L	Palato-max. B	$100\frac{B}{L}$	$100\frac{H'}{L}$	$100\frac{B}{H'}$	$100\frac{(B-H')}{L}$	$100\frac{H}{L}$	$100\frac{B}{H}$	$100\frac{fmb}{fml}$	$Oc.\ I$	$100\frac{G'H}{GB}$	$100\frac{NB}{NH}$, R	$100\frac{NB}{NH'}$	100
42	30	23	48	64	77·8?	77·7	100·7	0·5	77·7	104·9	84·2	58·2	68·0	50·0	49·1	76·
47	35	—	53	62	—	—	—	—	—	—	—	—	72·0	55·6	—	79·
46	34	22	—	—	86·5	78·9	109·6	7·6	77·9	111·1	87·2	57·5	—	50·0	50·0	79·
44	33	22	—	—	85·0	75·0	113·4	10·0	—	—	—	—	—	48·0	48·0	80·
—	—	—	—	—	87·0	80·4	108·1	6·5	—	—	—	—	—	—	47·2	—
39	30	—	49	62	92·3	79·8	116·4	13·0	78·1	118·2	—	61·6	—	54·3	52·1	76·
—	—	—	—	—	84·3	74·6	113·0	9·7	—	—	—	—	—	—	50·9	—
43	32	—	56	62	86·2	74·1	116·4	12·2	73·5	117·3	—	—	—	54·2	50·9	80·
43	30	—	48	62	87·0	76·8	113·3	10·2	76·3	114·1	89·7	59·4	—	54·1	54·1	75·
43	31	21	49	68	85·6	81·4	104·4	3·6	81·4	104·4	—	—	—	48·0	48·0	77·
—	—	—	—	—	83·5	73·8	113·4	9·8	—	—	—	—	—	—	—	—
42	36	—	—	—	—	—	—	—	—	—	—	56·3	—	—	—	92·
45	34	—	54	50	83·6	75·6	110·5	7·9	—	—	—	—	—	46·0	46·9	77·
—	35	—	—	—	—	74·7	—	—	71·9	—	—	—	—	—	47·1	87·
—	—	—	—	—	90·7	—	—	—	—	—	—	—	—	—	—	—
—	37	—	48	62	75·8	71·4	106·2	4·4	72·0	105·3	—	—	—	50·0	—	94·
—	33	—	54	58	72·8	75·1	94·4	−4·2	74·1	95·7	—	—	77·5	48·1	51·0	86·
—	39	—	—	—	—	—	—	—	—	—	—	—	—	43·9	—	97·
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	32	—	—	—	75·1	—	—	—	—	—	—	—	—	—	—	80·
—	—	—	—	—	81·3	—	—	—	—	—	—	—	—	—	—	—
—	36	—	51	61	78·2	72·6	107·7	5·6	—	—	—	—	67·0	53·1	54·2	90·
—	37	—	55	57	75·1	71·8	104·8	3·4	72·3	103·9	—	—	—	45·1	—	100·
—	33	—	53	66	85·6	70·0	122·2	15·5	70·1	122·1	—	—	56·8	50·0	48·0	72·
—	—	—	—	—	78·9	73·7	107·1	5·3	73·2	107·9	—	—	—	—	—	—
—	—	—	—	—	82·6	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	32	—	49	—	85·7	78·9	108·7	6·9	77·3	109·5	—	—	62·7	52·1	51·0	84·
—	—	—	—	—	—	77·9	—	—	79·7	—	—	—	—	54·0	—	—
—	—	—	—	—	75·7	64·0	118·2	11·6	64·0	118·2	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	87·2	78·3	111·3	8·9	—	—	—	—	—	—	—	—
—	—	—	—	—	80·1	72·3	110·7	7·7	—	—	—	—	—	—	—	—
—	—	—	—	—	—	76·1	—	—	—	—	—	—	—	—	—	—
—	34	—	—	61	82·3	71·0	116·0	11·3	—	—	—	—	—	—	44·2	87·
—	32	—	55	58	83·2	73·6	113·8	10·1	—	—	—	—	—	—	35·7	80·
—	—	—	—	—	80·6	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	81·7	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	84·6	78·8	107·2	5·7	—	—	—	—	—	—	—	—
—	—	—	—	—	73·9	70·0	105·6	3·9	—	—	—	—	—	—	—	—
—	—	—	—	—	86·4	80·2	107·7	6·2	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	78·3	—	—	—	—	—	—	—	—	—	—
—	29	24	—	—	79·6	76·3	104·3	3·2	—	—	80·6	—	—	—	49·0	76
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	35	26	—	—	77·2	70·6	109·6	6·7	—	—	84·6	—	—	—	40·2	89
—	—	—	—	—	78·0	76·3	102·1	1·6	—	—	—	—	—	—	—	—
—	—	—	—	—	77·9	74·7	104·3	3·2	—	—	—	—	—	—	—	—
—	—	—	—	—	81·0	80·4	100·7	0·6	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
43·4	33·4	23·0	51·6	60·9	81·9	75·3	109·1	6·7	74·6	110·2	85·3	58·6	67·3	50·4	48·3	84
10	23	6	14	14	37	35	31	31	15	13	5	5	6	17	19	2

ot provided by Reid.

	$100\frac{NB}{NH'}$	$100\frac{O_2}{O_1'}$	$100\frac{O_2}{O_1}$	Palato-max. index	$N\angle$	$A\angle$	$B\angle$
	49·1	76·9	71·4	133·3	61°·9	78°·2	39°·9
	—	79·5	74·5	117·0	—	—	—
	50·0	79·1	73·9	—	61°·2	77°·0	41°·8
	48·0	80·5	75·0	—	67°·3	77°·0	35°·7
	47·2	—	—	—	60°·5	70°·8	48°·7
	52·1	76·9	76·9	126·5	63°·7	75°·3	41°·0
	50·9	—	—	—	—	—	—
	50·9	80·0	74·4	110·7	71°·2	67°·8	41°·0
	54·1	75·0	69·7	129·2	69°·4	73°·6	37°·0
	48·0	77·5	72·1	138·8	69°·2	73°·2	37°·7
	—	—	—	—	—	—	—
	—	92·3	85·7	—	—	—	—
	46·9	77·3	77·8	92·6	65°·4	72°·9	41°·7
	47·1	87·5	—	—	—	—	—
	—	—	—	—	—	—	—
	—	94·9	—	129·2	—	—	—
	51·0	86·8	—	107·4	66°·8	72°·9	40°·3
	—	97·5	—	—	—	—	—
	—	—	—	—	—	—	—
	—	80·0	—	—	—	—	—
	—	—	—	—	—	—	—
	54·2	90·0	—	119·6	66°·0	71°·9	42°·1
	—	100·0	—	103·6	—	—	—
	48·0	72·7	—	124·5	66°·7	75°·3	38°·0
	—	—	—	—	—	—	—
	—	—	—	—	—	—	—
	—	—	—	—	—	—	—
	51·0	84·2	—	—	59°·8	78°·1	42°·1
	—	—	—	—	70°·0	76°·0	34°·0
	—	—	—	—	—	—	—
	—	—	—	—	—	—	—
	—	—	—	—	—	—	—
	—	—	—	—	—	—	—
	—	—	—	—	—	—	—
	44·2	87·2	—	—	61°·9	78°·7	39°·4
	35·7	80·0	—	105·5	63°·2	71°·7	45°·1
	—	—	—	—	—	—	—
	—	—	—	—	—	—	—
	—	—	—	—	—	—	—
	—	—	—	—	—	—	—
	—	—	—	—	—	—	—
	—	—	—	—	—	—	—
	—	—	—	—	—	—	—
	—	—	—	—	—	—	—
	49·0	76·3	—	—	—	—	—
	—	—	—	—	—	—	—
	40·2	89·7	—	—	—	—	—
	—	—	—	—	—	—	—
	—	—	—	—	—	—	—
	—	—	—	—	—	—	—
	—	—	—	—	—	—	—
	48·3	84·0	75·1	118·3	65°·3	74°·4	40°·3
	19	23	10	13	16	16	16

To face p. 388.

No.	Locality	When found	Collection
52	Tyrie (Boyndlie), Aberdeenshire	1872	University of Aberdeen
53	Foveran "	1869	" "
54	Belhelvil "	1915	" "
55	Keiss, Caithness-shire	—	University of Edinburgh
56	Kinaldie, Aberdeenshire	1855	Museum of Soc. Antiquaries, Edin.
57	Inverurie "	1867?	" " "
58	Tealing, Forfarshire	1870?	" " "
59	Windy Mains, East Lothian	1857?	" " "
60	Langside, Lanarkshire	1911	University of Glasgow
61	Townhill, Pomona, Orkney Islands	1859	Royal Coll. of Surgeons, Eng.
62	Rindall " " "	1859	" " "
63	Roseisle, Elginshire	1857	" " "
64	Near Belmont Castle, Perthshire	1859	" " "
65	Dunrobin, Sutherlandshire	1880	— — —
66	Inveresk, Kirk Park, East Lothian	—	— — —
67	Cockenzie, East Lothian	—	— — —
68	Ninewells, Invergowrie, Forfarshire	1865?	— — —
69	Roseisle, Elginshire	1860	— — —
70	Knowe of Saverough, Pomona, Orkney Islands	—	Cambridge Museum of Anatomy
71	" " " "	—	" "
72	" " " "	—	" "
73	Sanday Island, Orkney Islands	—	" "
74	Hanay, Pomona "	—	" "
75	Bennet Hill, Elginshire	—	— — —
76	Stonelaws, East Lothian	—	— — —
77	Rendall, Pomona, Orkney Islands	—	Royal Coll. of Surgeons, Eng.

Measurements given by	Sex	*C*	*F*	*L*	*B*	*B'*	*H*	*H'*	*OH*	*LB*	Broca's transverse arc	*S*	S_1	S_2
Reid, Turner	♀	1460	168	172	150	—	—	127	—	97	304	353	127	110
,, ,,	,,	—	174	172	135	—	—	—	—	—	300	355	128	122
Reid	,,	—	175	177	146	—	131	133	—	97	—	—	131	101
,,	,,	—	183	184	132	—	136	132	—	98	—	—	—	—
Reid, Turner	,,	—	—	178	—	—	122	121	—	96	—	—	127	—
,, ,,	♀?	—	179	182	—	—	132	132	109	104	—	—	—	—
,, ,,	,,	1448	177	179	138	—	134	134	103	104	303	361	128	—
,, ,,	,,	—	172	172	—	—	139	138	116	106	—	349	120	130
Reid	♀	—	181	184	150	—	133	131	108	104	—	—	—	—
Reid, Garson, etc.	♀?	1450	187	190	142	99	141	139	117	103	—	383	125	135
,, ,,	♀	1320	177	176	145	98	130	132	113	99	—	365	135	120
Reid, Barnard Davis	,,	—	174	176	—	—	136	135	113	97	—	366	127	123
,, ,,	,,	—	175	—	145	—	—	—	116	—	—	363	124	132
Turner	,,	1540	—	178	146	—	—	132	—	99	325	370	132	118
,,	,,	—	—	172	—	—	—	127	—	95	—	357	125	130
,,	,,	—	—	173	135	—	—	127	—	90	294	364	120	128
,,	,,	—	—	175	—	—	—	—	—	—	—	—	—	—
,,	,,	—	—	164	135	—	—	123	—	95	—	335	116	118
Garson, also Davis and Thurnam	♀?	—	190	193	134	95	—	—	—	—	—	380	122	132
,, ,, ,,	,,	—	183	190	133	99	—	124	—	103	—	358	120	120
,, ,, ,,	,,	—	190	198	137	98	—	—	—	—	—	382	131	129
Garson	♀	—	165	172	138?	90	—	—	—	95	—	—	—	—
Garson, also Davis and Thurnam	,,	—	185	185	138?	—	—	—	—	—	—	—	137	131
Busk	,,	—	173	173	142	91	—	—	—	—	—	348	122	117
Davis and Thurnam	,,	—	185	—	137	—	—	—	—	—	—	383	137	127
Garson, also Barnard Davis	,,	1250	180	180	135	99	—	123	—	98	—	354	130	134
Mean ...	—	1411·3	178·7	179·0	139·7	96·1	133·4	130·0	111·9	98·9	305·2	362·6	126·9	124
No. ...	—	6	20	24	20	8	10	17	8	18	5	18	21	19

APPENDIX II.

dividual Measurements of Female Adult Scottish Short Cist Skulls.

	S_1	S_2	S_3	S_3'	U	*fml*	*fmb*	*G'H*	*GL*	*GB*	*J*	*PH*	*NH, R*	*NH'*	*NB*	O_1'	
3	127	110	116	96	503	37	—	66	93	—	130	20?	47	48	25	40	
5	128	122	105	—	467	—	—	—	—	—	—	—	—	—	—	—	
-	131	101	—	—	—	36	26	—	—	—	—	—	48	—	23	39	
-	—	—	—	—	—	—	—	66	92	90	123	15?	51	—	23	38	
-	127	—	—	—	—	—	—	67	100	—	—	17?	47	49	23	43	
-	—	—	—	—	—	—	—	56	98	93	—	18?	46	—	25	49	
1	128	—	—	—	517	38	—	69	93	114	—	20?	51	52	26	40	
9	120	130	99	—	—	38	—	—	—	—	—	—	—	41	—	—	
-	—	—	—	—	—	—	—	61	91	—	—	21?	49	—	23	41	
3	125	135	123?	—	535	38	—	75	93	—	—	24?	52	53	25	40	
5	135	120	110	—	515	36	31	63	95	96	125?	21?	44	43	26	38	
6	127	122	117	—	—	—	—	70	88	—	—	19?	53	—	26	—	
3	124	132	107	—	513	—	—	—	—	—	—	—	—	—	—	—	
0	132	118	120	—	518	38	—	63	95	—	—	—	—	45	24	39	
7	125	130	102	—	—	—	—	61	87	—	—	—	—	47	—	—	
4	120	128	116	—	494	—	—	—	90	—	—	—	—	47	22	35	
-	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
5	116	118	101	—	—	33	—	63	—	—	—	—	—	—	—	—	
0	122	135	123	—	520	—	—	—	—	—	—	—	—	—	—	—	
8	120	120	118	—	516	39	31	—	—	—	—	—	—	—	—	—	
2	131	129	122	—	—	—	—	—	—	—	—	—	—	57	28	—	
-	—	—	—	—	500?	—	30	—	97	—	—	—	—	46	23	37	
-	137	131	—	—	520?	—	—	—	—	—	—	—	—	—	—	—	
8	122	117	109	—	493	—	—	—	—	—	—	—	—	—	—	—	
3	137	127	119	—	518	—	—	—	—	—	—	—	—	—	—	—	
4	130	134	90	—	505	37	—	—	95	—	124	—	—	46	24	40	
2·6	126·9	124·2	111·6	96	508·9	37·0	29·5	65·0	93·4	98·3	125·5	19·4	48·8	47·8	24·4	39·9	
8	21	19	17	1	15	10	4	12	14	4	4	9	10	12	15	13	

NH, R	NH'	NB	O_1'	O_1	O_2	DC	Palato-max. L	Palato-max. B	$100\frac{B}{L}$	$100\frac{H'}{L}$	$100\frac{B}{H'}$	$100\frac{(B-H')}{L}$	$100\frac{H}{L}$	$100\frac{B}{H}$	$100\frac{fmb}{fml}$	$Oc.\ I$	10
47	48	25	40	43	33	23	50	62	87·2	73·8	118·1	13·4	—	—	—	59·4	
—	—	—	—	—	—	—	—	—	78·5	—	—	—	—	—	—	—	
48	—	23	39	39	33	20	—	—	82·5	75·1	109·8	7·4	74·0	111·5	72·2	—	
51	—	23	38	—	37	—	50	57	71·7	71·7	100·0	0·0	73·9	97·1	—	—	
47	49	23	43	—	30	—	54	60	—	68·0	—	—	68·5	—	—	—	
46	—	25	49	—	29	—	54	61	—	72·5	—	—	72·5	—	—	—	
51	52	26	40	—	33	—	45	62	77·1	74·9	103·0	2·2	74·9	103·0	—	—	
—	41	—	—	—	—	—	—	—	—	80·3	—	—	80·8	—	—	—	
49	—	23	41	—	32	—	50	57	81·5	71·2	114·5	10·3	72·3	112·8	—	—	
52	53	25	40	—	33	20	—	—	74·7	73·2	102·2	1·6	74·2	100·7	—	—	
44	43	26	38	—	30	23	—	—	82·4	75·0	109·8	7·4	73·9	111·5	86·1	—	
53	—	26	—	—	—	—	—	—	—	76·7	—	—	77·2	—	—	—	
—	—	—	—	—	—	—	—	—	—	74·7	—	—	—	—	—	—	
—	45	24	39	—	35	—	—	—	82·0	74·2	110·6	7·9	—	—	—	—	
—	47	—	—	—	—	—	—	—	—	73·8	—	—	—	—	—	—	
—	47	22	35	—	32	—	52	—	78·1	73·4	106·3	4·6	—	—	—	—	
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
—	—	—	—	—	—	—	—	—	82·3	75·0	109·8	7·3	—	—	—	—	
—	—	—	—	—	—	—	—	—	69·4	—	—	—	—	—	—	—	
—	—	—	—	—	—	—	—	—	70·0	65·3	107·3	4·7	—	—	79·5	—	
—	57	28	—	—	—	21	—	—	69·2	—	—	—	—	—	—	—	
—	46	23	37	—	33	—	—	—	80·2?	—	—	—	—	—	—	—	
—	—	—	—	—	—	—	—	—	74·6?	—	—	—	—	—	—	—	
—	—	—	—	—	—	—	—	—	82·8	—	—	—	—	—	—	—	
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
—	46	24	40	—	34	23	—	—	75·0	68·3	109·8	6·7	—	—	—	—	
48·8	47·8	24·4	39·9	41·0	32·6	21·7	50·7	59·8	77·7	73·2	108·4	6·1	74·2	106·1	79·3	59·4	
10	12	15	13	2	13	6	7	6	18	18	12	12	10	6	3	1	

$100\frac{fmb}{fml}$	*Oc. I*	$100\frac{G'H}{GB}$	$100\frac{NB}{NH}$, *R*	$100\frac{NB}{NH'}$	$100\frac{O_2}{O_1'}$	$100\frac{O_2}{O_1}$	Palato-max. index	*N* ∠	*A* ∠	*B* ∠
—	59·4	—	53·2	52·1	82·5	76·7	124·0	67°·0	73°·2	39°·8
—	—	—	—	—	—	—	—	—	—	—
72·2	—	—	47·9	—	84·6	84·6	—	—	—	—
—	—	73·3	45·1	—	97·4	—	114·0	65°·7	74°·7	39°·6
—	—	—	48·9	46·9	69·8	—	111·1	73°·2	67°·2	39°·6
—	—	60·2	54·3	—	59·2	—	113·0	68°·6	79°·6	31°·8
—	—	60·5	51·0	50·0	82·5	—	137·8	61°·5	78°·4	40°·1
—	—	—	—	—	—	—	—	—	—	—
—	—	—	48·9	—	78·0	—	114·0	61°·2	83°·1	35°·7
—	—	—	48·1	47·2	82·5	—	—	61°·1	75°·3	43°·6
66·1	—	65·6	59·0	60·5	79·0	—	—	68°·0	74°·7	37°·3
—	—	—	49·1	—	—	—	—	61°·4	74°·6	44°·0
—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	53·3	89·8	—	—	68°·0	74°·3	37°·7
—	—	—	—	—	—	—	—	64°·1	77°·3	38°·6
—	—	—	—	46·8	91·4	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—
99·5	—	—	—	—	—	—	—	—	—	—
—	—	—	—	49·2	—	—	—	—	—	—
—	—	—	—	50·0	89·2	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	52·2	85·0	—	—	—	—	—
99·3	59·4	64·9	50·6	50·8	82·4	80·7	119·0	65°·4	75°·7	38°·9
3	1	4	10	10	13	2	6	11	11	11

To face p. 388.

ON THE IMPORTANCE OF THE TYPE SILHOUETTE FOR RACIAL CHARACTERISATION IN ANTHROPOLOGY.

By IDA McLEARN, G. M. MORANT and KARL PEARSON.

In the Anthropometric Department of the Galton Laboratory we have an apparatus designed by one of us to draw life-sized silhouettes. Besides the contour itself it records on the drawing by aid of a simple mechanism the projection of the suborbital point, and the point where the axis of the ear-plug meets the plane of the silhouette. This point, which may conveniently be termed the *Mesoporion*, does not, of course, coincide with the highest point of the auricular passage which it is convenient to term the *Hyperporion*. The hyperporion is lower by the thickness of the flesh than the points which in the skull are termed in the Biometric Laboratory the "auricular points," i.e. the points on which the skull has contact with the knife-edges of the craniophor arms. Our "auricular point" on the skull agrees with Martin's porion, but not with the "point sus-auriculaire" or Martin's *auriculare*. Knowing the average height, about 8 mm., of the craniometric porion above the mesoporion, we can strike a circle of 8 mm. radius and the tangent to the upper arc of this circle from the suborbital point will give with considerable approximation the trace of the Frankfurt Horizontal on the silhouette. In this way the point A, slightly above the hyperporion, and supposed to correspond to the auricular point of our craniometric work, is determined on the individual silhouettes. The auricular point A is joined to the most recedent point N of the nasal trough, which to distinguish it from the nasion may be termed the *Hyperrhinion**. The line NA and the perpendicular to it through A are taken as coordinate axes for determining the position of other points on the contour. As in cranial contours we take our standard length, in this case NA, and divide it into five or ten equal parts as the case may be, and these are used as units both anteriorly and posteriorly with regard to A. Further, as the thickness of the hair in Europeans is a highly variable quantity, these units were measured off on the line through A perpendicular to AN, i.e. the y-axis, to save a *double* influence of the hair in reading the abscissae for the back of the head; otherwise the vertical through A would, as in the cranial contours, have been divided into ten equal parts. The abscissae of these ordinates on the back of the head have been read off. By aid of the above axes a network of coordinate values is then taken over the area of the individual contour, assisted by chords and subtenses where needful. See Figs. 1—3. Next, on all these individual contours the angle between the lines joining the auricular point to the hyperrhinion and to the suborbital point is

* The hyperrhinion corresponds to "the most depressed part of the root of the nose" (in the mid-sagittal plane) of some anthropologists; for us it is the point on the nasal bridge (mid-plane) nearest to A.

measured. All the ordinates and the abscissae, the chords and the subtenses, are then averaged. Further, the mean angle between the trace of the Frankfurt Plane on the Mid-sagittal Plane and the AN line is determined, and its value enables us to set the type contours into a standard position, i.e. in Plates I to III the horizontal is that of the Frankfurt Plane. Thus in superposing a contour on tissue upon a silhouette, the continuous line crossing its area should be made parallel to the top (or bottom) of the paper. We think it may be taken, as some confirmation of the accuracy with which the measurements have been made, that the slope of AN to the Frankfurt Horizontal comes out 12°·4 for English Males and 12°·5 for English Females. It is also some justification for the use of this plane, if it be an asexual racial character. For the Negro Male it is somewhat less, i.e. 11°·9. Remembering that the hyperrhinion is *not* the nasion, we find this angle on the Farringdon Street seventeenth-century crania to be slightly over 13°·5 for males and slightly under for females*.

There are several points on the silhouette not available on the skull, or not corresponding to definite points on the skull, which it is convenient to name and to letter. A point which has no cranial existence, but which comes out markedly

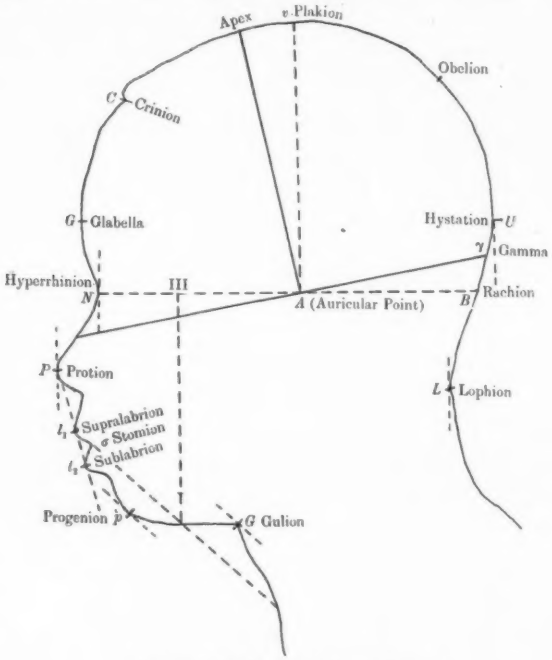


Diagram of Cephalic Points on Silhouette.

* This difference of a degree, roughly, at least in part is possibly due to the flesh covering the suborbital point.

on the silhouette, at least if the composite does not contain many bald individuals, is the hair-line, or on the contour the hair-point; it might be marked with the letter C, and is termed the *Crinion**. We next have the nasal tip T, the point of the nasal contour farthest removed from the line through A perpendicular to AN; this may be termed the *Protion* as marking the most forward part of the face. It is not necessarily coincident with the pronasale. Descending lower we have a point quite indeterminate on the skull, namely σ, the point marking the lip-line which has been termed the *Stomion*. The point P on the chin farthest removed from the protion-stomion line may be termed the *Progenion*. It is not identical with the pogonion, still less with the gnathion. Next the point where the under-surface of the chin changes into the surface of the throat, a very recognisable bend in European type silhouettes and almost a "singular point" in the Negro, may be termed the *Gulion*. In different races the determination of the gulion may have to be made in different manners; e.g. in the English silhouettes it was found by joining the progenion to the tip of the ordinate below II′ and producing this line to meet the contour; in the Negro silhouette, the base of the chin-throat segment was taken to be the line joining the stomion to the tip of the ordinate below III′.

It must be remembered that the draughtsman in preparing the silhouette is not confined to the points we have marked on Figs. 1—3. He can put in additional points whenever and wherever he finds those existing inadequate to give the contour, by the simple process of striking one or two additional averages, and in fact such additional points were obtained, beyond the marked points, on these contours.

Taking still the line perpendicular to NA as our guide, we have a point at the extreme back of the head which is not necessarily identical with the occipital point. We may term it the *Hystation* and use the letter U for it. The hystation could not be satisfactorily determined on the undergraduate women as about half of them were still wearing long hair. The back of the head had to be determined from those whose hair was cut very short male-fashion. The hystation is not necessarily the most posterior point of the back of the head, when the silhouette is orientated to the Frankfurt Horizontal, although it is practically so in the European silhouette. The point B, where NA produced backwards meets the back of the head, is very convenient as a point of reference, it may be termed the *Rachion*. Finally the most anterior point on the nape of the neck, again judged by the perpendicular to AN, may be termed the *Lophion*, and the point on the top of the head farthest removed from the line AN, and usually very closely coinciding with the top of the ordinate at A, the *Plakion*. This must not be confused with the *Apex*, the point in which a line through A perpendicular to the Frankfurt Plane would meet the mid-sagittal contour.

In the comparison of silhouettes it is very desirable to have names for points which cannot be confused with points more or less—generally rather less than more—corresponding with those on the skull. The above terms will enable us to compare without danger of misunderstanding any two type silhouettes.

* The term *Trichion* is used by some anthropologists.

In order to obtain good racial type silhouettes, especially of native races, when no special apparatus is available, we have to appeal to the camera. And in this matter the camera may be used accurately, i.e. with some idea of what it can achieve, or it may not. Careless taking of profile photographs with little or no standardisation is idle for our present purpose. The camera—if possible a telephoto-lens—should be set at a considerable distance from the subject. The reduction on the focussing plane should always be the same, or, if not, noted in the case of each photograph. The subject should be placed exactly in profile and the head adjusted by means of a head-rest until the suborbital and auricular points are on a horizontal line on the focussing plane. Or, without such adjustment, a small white wafer may be used to mark the suborbital point, and a very short ear-plug with a coaxial white disc on a bent arm, easily devised, may be used to mark the centre of the auricular passage. If photographs are taken all on different scales and with no indication of the Frankfurt Plane, even if they are in true profile, the work of forming a type silhouette becomes very laborious. All the measurements of each individual silhouette have first to be reduced to some arbitrary *AN*, before averaging, and then when the type silhouette has been drawn it must be modified by enlarging or diminishing until some individual length, e.g. glabella-occipital length, is equal to the mean corresponding length as determined on the living heads*. We have taken as an illustration of how photographic work well done can provide a very typical racial silhouette the profile photographs of one hundred West African Negroes taken by Rudolf Pöch and Johann Weninger, and published by the Viennese Anthropological Society under the general title, *Rudolf Pöchs Nachlass, Serie A: Physische Anthropologie*, Band I, with the special title: *Eine morphologisch-anthropologische Studie, durchgeführt an* 100 *westafrikanischen Negern, als Beitrag zur Anthropologie von Afrika*, Wien, 1927.

The Negroes were prisoners captured from the French in the Great War and measured in their camps by Pöch and his assistants. They were drawn from French West Africa—Senegal, Upper Senegal and Niger, French Guinea, the Ivory Coast, Dahomey, and the Military Territory of the Niger, belonging chiefly to the Bambara, Tukulor, Malinke, Wolof and Susu tribes. We have not thought it desirable to break up the entire group into separate tribes, we should have been obliged to take our averages on far too few individuals†. Thus our silhouette does not represent any particular tribe, but the West African Negroes from the French possessions stretching from Senegal to Dahomey and northward to the Senegal and Niger rivers. Our silhouette therefore will not indicate tribal differences, which it would be most desirable to indicate in this manner when the field anthropologist has collected enough material. It represents what we have entitled it: a generalised

* Unfortunately few anthropologists take the length *AN*, i.e. the distance from auricular point to hyperrhinion, or the result might be checked on this. If the nasal height from hyperrhinion to the subnasale be taken, as is sometimes done, this will serve as a check. The auricular vertical height will be even more useful.

† Of the Bambara there were 27, of the Tukulor 16, of the Malinke 11, of the Wolof 10, of the Susu 6, and of various small groups, 30 individuals.

West African Negro; and it might profitably be compared with the silhouettes based on similar series from South and East Africa. The Negro chin is so different from the European that points on it could not be found from the protion-stomion join; it was needful to base them on the line joining the stomion to the top of the ordinate below III′. Other slight modifications of construction were made, and will probably always be needful, when we pass from one race to a second.

If we wish to compare our silhouette with the means of the Pöch-Weninger measurements, we must bear in mind three separate points:

(i) In taking measurements up to the hair surface of the head, the silhouette will include the hair while the callipers will hardly be affected at all*.

(ii) The position of the true glabella is not really given by the silhouette, for it would be obscured by massive frontal sinuses or heavy eyebrows—the latter not being, however, very emphasised in the Negro.

(iii) The gnathion, the prosthion and the nasion are not determinable on a silhouette. Personally we doubt whether the nasion can be determined on the living and much prefer to use the hyperrhinion.

In measuring lengths on nose and face, Weninger refers to Martin's definitions (18), (20) and (21), which involve a knowledge of the nasion on the living. Martin thinks the cranial nasion, i.e. the intersection of the sutura nasofrontalis with the median sagittal plane, can be found on the living after some practice. We have doubts as to the correctness of this view, and feel confident that the hyperrhinion is not only more easily ascertained on the living, but is of more importance from the physiognomic aspect of ethnography. There is no great advantage in trying to make physiognomic points coincide with anatomical.

The Pöch-Weninger profile photographs are said to be one-fifth linear in scale and they are all taken in a standard position. Miss Ida McLearn undertook the laborious task of enlarging them to life size from the photographs by aid of a Coradi precision pantagraph. This was achieved in two stages, a very accurate

* Unfortunately the Pöch-Weninger memoir refers only to Martin's definitions of points and measurements without the further detail, so necessary, of how they have interpreted them. Martin's words are often not free from obscurity and we may perhaps cite as illustration a single instance. On p. 162 of Pöch-Weninger we learn that the auricular height of the head has been taken by Martin (15). Now we venture to say that it is absolutely impossible without having in the hands a copy of the particular instrument that Martin had before him (of which there is no illustration in his volume) to understand what the author means. How is it possible to lay with the left hand "das obere Lineal möglichst horizontal auf den Scheitel senkrecht zur Ohraugen Ebene"? (Martin, Bd. I. S. 188). How can a "Lineal" be at the same time horizontal and yet perpendicular to an almost horizontal plane? If we pass by the difficulties of this description of a measurement—which requires us to obtain a special instrument from a particular maker in order to grasp it in the least—we are thrown back for our lower point of the measurement on Martin's definition of the tragion. It reads: "derjenige Punkt am Oberrand des Tragus, der an der Kreuzungsstelle einer an den Vorderrand und einer an den Oberrand dieses Knorpels gelegten Tangente gelegen ist" (Martin, Ausgabe 1928, Bd. I. S. 145). Besides the fact that the upper and anterior borders of a continuous surface have innumerable tangents, it is impossible to understand how the meet of any two tangents can lie on the border which they touch.

We suggest to the reader that he should examine the photographs of ears on Pöch-Weninger's Plates G—J, and endeavour to locate the tragion by the above definition!

worker using a very accurate instrument. On these life-sized individual silhouettes all the measurements were taken. From the means of these the type silhouette was constructed, but being too large for the pages of *Biometrika*, it was carefully reduced to half linear scale by photography. Our measurements for comparison are taken on the contour in Fig. 1.

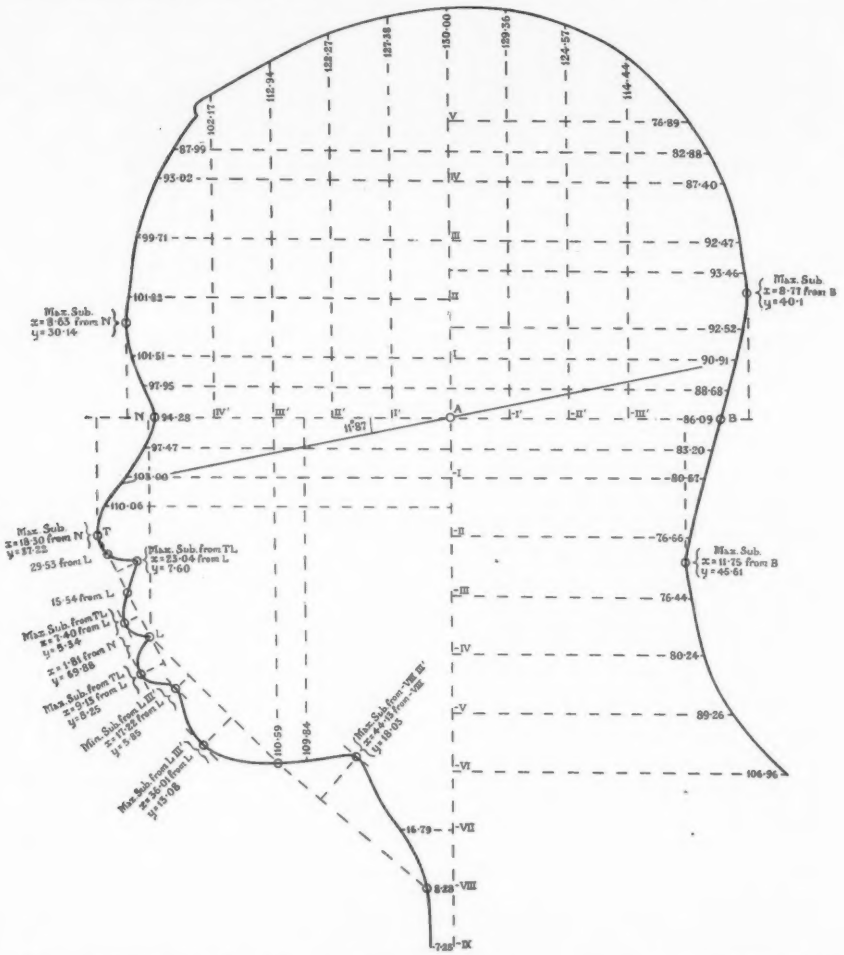


Fig. 1. Type West African Negro silhouette, showing network of mean coordinates from which it was plotted, and the Frankfurt Horizontal, as indicated by the continuous line through the Auricular Point, *A*.

(*a*) *Nasal Height.* On the contour from *N*, the hyperrhinion, to the subnasale = 23·5 half units = 47·0 mm. If this were correct the Pöch-Weninger measure-

ment of 48·0 mm. would indicate that the nasion in Negroes was only 1 mm. higher than the hyperrhinion. We are inclined to believe that in most cases these anthropologists used "the most depressed part of the nasal bridge" and not the true nasion.

(*b*) *Upper Face Height.* We can only guess the position of the prosthion from knowledge of the stomion and the shape of the upper lip, we make the distance about 33·0 half units or 66·0 mm. Pöch-Weninger give it as 66·78 mm., again about 1 mm. in excess of our value, which confirms our suggestion that their prosthion-nasion measurement on the living was really a prosthion-hyperrhinion length.

(*c*) *Morphological Face Height.* Defined to be from gnathion to nasion, Pöch-Weninger give it (*loc. cit.* S. 47) as 117·75 mm. As far as it is feasible to locate the gnathion on a silhouette we should make the distance about 58·3 half units or 116·6 mm. Again about 1 mm. too small. This is confirmatory of (*a*) and (*b*). We now turn to the head diameters.

(*d*) *Maximum Length.* On the silhouette this is 98·8 half units or 197·6 mm. Pöch-Weninger (S. 29) give the "Länge des Kopfes" as 191·35 mm. This allows 6·25 mm. for the hair at the back of the head, and for recedence of the glabella relative to the frontal sinus and the eyebrow. This does not seem by any means too ample an allowance.

(*e*) *Auricular Height.* We have already referred to the difficulties involved in Martin's definition of the measurement of this length and in particular the obscurity involved in his statement as to the tragion. We had equal difficulty in determining what we considered to be the auricular point on the small photographs. Naturally we did not aim at Martin's tragion, as we found the definition unintelligible, and believe that the auricular height on the living should be taken by ear-plug callipers. Martin states that the "point sus-auriculaire" lies higher than the tragion. Now the height of the Negro silhouette from *A* perpendicular to the horizontal is almost exactly 64·0 half units or 128·0 mm. The auricular height (Ohrhöhe) as given by Pöch-Weninger on S. 33 is 127·92 mm. These two are almost the same in magnitude, whereas the silhouette includes the 4 mm. of hair on the top of the Negro's head. If Pöch-Weninger used the apparatus so vaguely described by Martin, it would suggest that a "Lineal" or straight-edge was placed across the head parallel (?) to the auricular axis*. Such "Lineals" ought not to be used as they cannot penetrate the layer of hair, like a vertical blunt-pointed rod does; they simply compress the hair, by how much it is impossible to say. We should give the Negro some 5 mm. average thickness of wool at the crown of his head, and it is possible that Pöch-Weninger included 2 to 3 mm. of this. The remaining 3 to 2 mm. would represent the height of our auricular point above the tragion as defined by Martin, not an unreasonable amount. All we can say is that we do not find any definite contradiction between the silhouette measurement and the Pöch-Weninger mean "Ohrhöhe."

The above are all the measurements which can be compared on the silhouette with those taken by Pöch-Weninger on the corresponding 100 West African Negroes.

* Martin, *Lehrbuch*, 3te Ausgabe, Bd. I. S. 185.

Taken all round and bearing in mind the vague definitions provided of how the measurements were actually obtained, we think we must say that our Negro silhouette is in substantial accord with the corresponding mean measurements on the living subject. In other words we have reached a truly typical West African Negro.

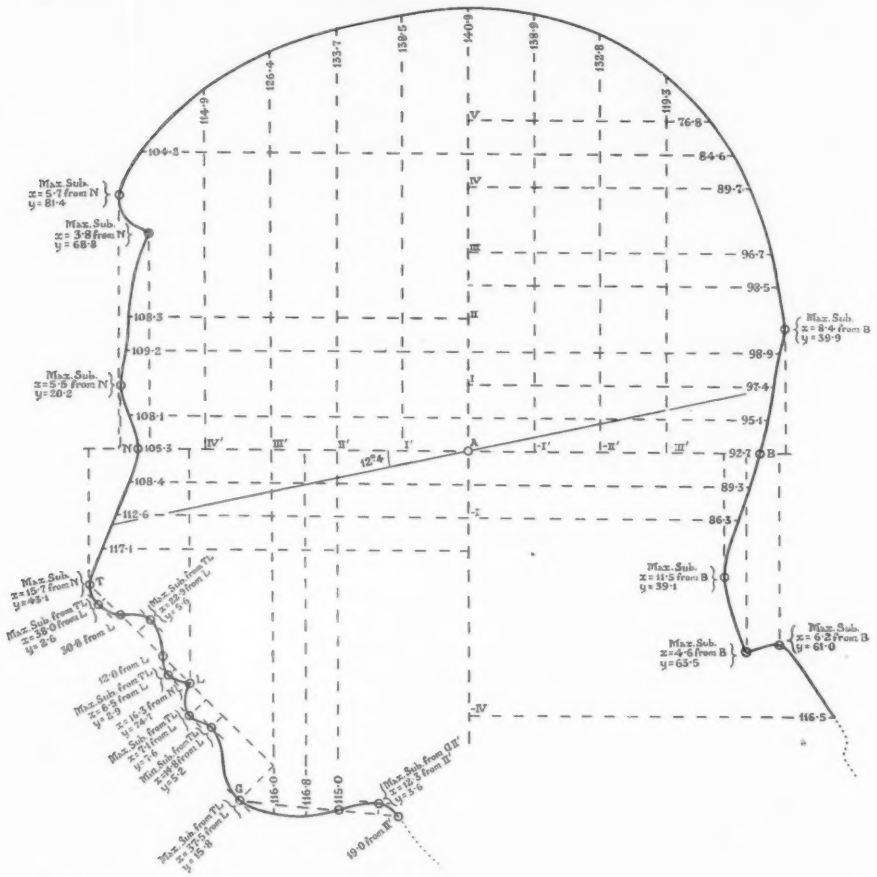


Fig. 2. Type English ♂ silhouette, showing network of mean coordinates from which it was plotted, and the Frankfurt Horizontal, as indicated by the continuous line through the Auricular Point, *A*.

At present the subject of type racial silhouettes has been so little worked at that it is not possible to make the sort of comparisons which these constructions are designed to further. All we can do is to give two illustrations of what can be learnt from them.

I. *Comparison of the English Type Silhouettes for Male and Female.* We will start by superposing the English Male tissue on the Female contour (p. 398). Auricular point *A* is placed on auricular point *A*, and the Frankfurt Horizontals are made to agree; it will be seen that the male head is in every direction, except that of the occipital, outside the female head, and the female occipital excess is, we think, due to the larger amount of hair at the back of the head in women. To get a better comparison slide the male auricular point *A* back along the female Frankfurt line, until the hyperrhinions come into contact, keeping the Frankfurt Horizontals superposed. It will at once be seen that from the protion to the glabella, for the nasal bridge and three-quarters of the nose, the contours of young male and female almost coincide. The great prominence of the glabella in the male is screened in the female by her forehead rising vertically above the glabella, while the male's forehead recedes. The first noteworthy sexual difference comes in with the forehead height—the forehead height from hyperrhinion to crinion in the female is only about *two-thirds* of the corresponding forehead height in the male. From the crinion onwards the male head rises above the female with increasing differences till at the apex, notwithstanding the greater thickness of the female hair, there is an excess of 8 mm. The difference continues to increase until the separation of the two contours amounts to about 12 mm. in the neighbourhood of the obelion. The contours then approach—this being largely due, I think, to the greater profusion of the woman's hair—until a minimum of about 1·5 mm. is reached in the neighbourhood of the hystation. Lastly we note on the neck how the lophion is drawn forward in the woman so that her neck has only about four-fifths of the diameter of that of the male; the gulions with our present orientation nearly coinciding.

Turning to the faces of the male and female below the protion we note several interesting sexual differences. In the first place the contour of the female nose turns more sharply inwards below the protion, but the two subnasales are in close proximity; the result is to give the female a less rounded nasal tip and a shorter nasal base than is the case with the male. Her upper lip is considerably shorter and projecting beyond that of the male is more nearly vertical; the shortness of the upper lip brings her stomion well above that of the male. Again the contours cross and while the male chin is almost vertical the shorter female chin actually protrudes. This secondary sexual character was, as some may remember, a marked factor in the charm of the late Miss Ellen Terry. While the chin of the woman is shorter and more protuberant than that of the male, it turns sharply inward just below the progenion, and runs almost horizontally above the more rounded male contour back to its gulion, which is some 6 mm. from that of the male.

If the reader tries other adjustments of the two contours, he will find still these sexual differences maintained; the female contour is not a mere reduction in size of the male contour, its proportions are different. Yet the resemblances are greater than the differences when we come to study the relations of the type male silhouettes belonging to two different races.

II. *Comparison of the English Male Type Contour and that of the Male West African Negro.* If we place the English male tissue on the West African contour (p. 394) so that their auricular points coincide and their Frankfurt Horizontals are in the same line, we grasp at once how very much larger is the English head. There are only three portions of the Negro contour which protrude, the upper lip and the lower lip (so that the Negro stomion is on the contour of the upper lip of the Englishman) and the chin. This of course is a measure of negroid prognathism.

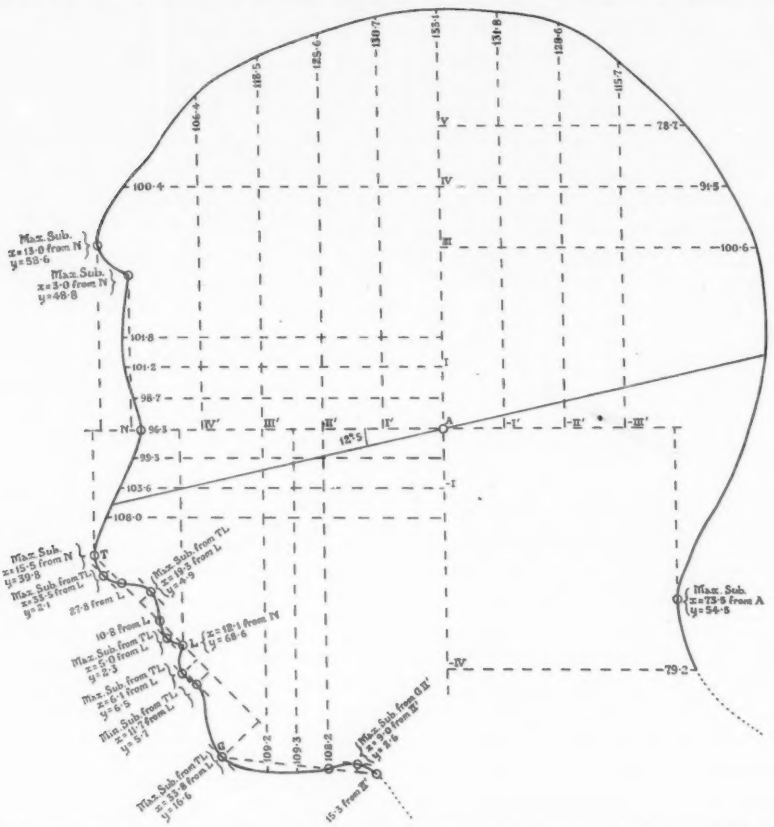


Fig. 3. Type English ♀ silhouette, showing network of mean coordinates from which it was plotted, and the Frankfurt Horizontal, as indicated by the continuous line through the Auricular Point, *A*.

Now let us bring the hyperrhinion to superposition with the hyperrhinion, keeping the Frankfurt Horizontals parallel; we can no longer superpose them. The prognathism is now still more marked; the whole of the Negro's lips and chin project, but his chin rises with the under surface of the jaw well above the English, the gulion being situated nearly a centimetre farther forward. The Negro nose is

much shorter, and with a much smaller base; it is so rounded at the protion that it protrudes beyond the English, giving the Negro his snub-nose appearance. The nasal bridges, as we might anticipate from our setting, closely coincide, but the glabella of the Negro is higher and his frontal more nearly vertical, and so outside the Englishman's. His crinion is much above the English crinion, but the whole of the parietal and occipital regions are most markedly within the English contour. Something of this is due to the difference of hair thickness in the two races, but far from all of it. We may say that the Negro race is a "high brow" race, or that "high brows" are a negroid characteristic; we leave the reader to his choice. We have repeatedly stated in this Journal that a vertical forehead of large extent by no means connotes marked intelligence, although a retreating forehead with parietal compensation not infrequently is associated with special ability. The term "high brow" was probably not invented by an anthropologist, still less by an anatomist familiar with the "infantile forehead."

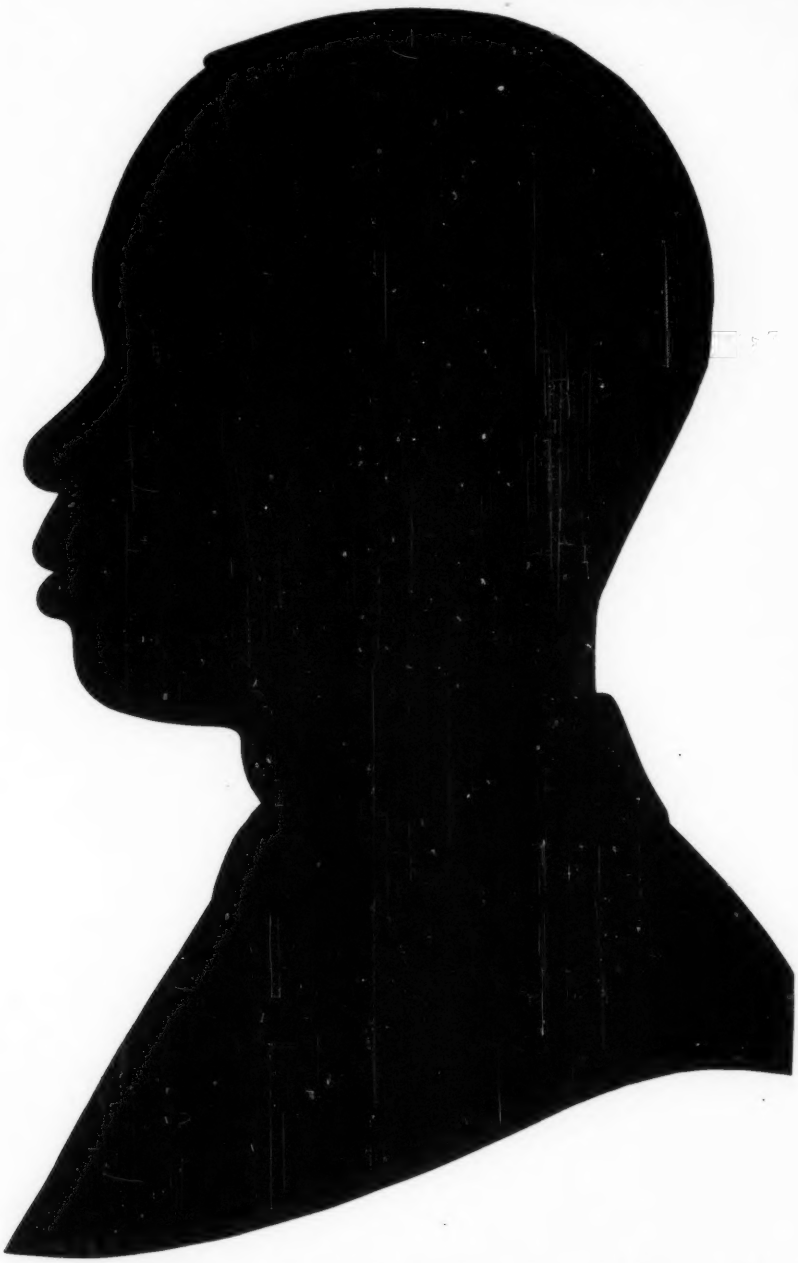
The distance between the contours increases steadily from plakion to hystation and then remains fairly constant from hystation to rachion and even to the lophion. The distance from lophion to gulion is less for the Negro than for the Englishman; he has on the average a smaller neck. The reader who has followed the above comparison of Negro and Englishman will see that, apart from absolute size, the former differs from the latter in several points corresponding to those in which the Englishwoman differs from the Englishman. It is therefore of some interest to superpose the English female tissue on the Negro male contour (p. 394). The Auricular Points and Frankfurt Horizontals being made to coincide, the result is somewhat startling. There is a fairly close accordance of forehead, nasal bridge and nose. The top of the head and even the back of the head may be only a difference of hair thickness; the Englishwoman has a slightly smaller neck than the Negro, but the respective gulions and lophions are in close proximity. Even the general curvature of the frontals is much the same, and but for the fact that the crinion is so much higher in the Negro the frontal resemblance would probably be much more marked. Wherein arises the great difference in physiognomy between the Negro and the Englishwoman? It may not have been thus far recognised, but it lies apart from the hair, not in the nasal or frontal lines but in the face below the protion.

The nasal base of the Negro is very short and curves almost upwards, before it reaches the subnasale. Then comes his straight and heavy upper lip, with the stomion thrown 6 to 7 mm. forward, followed by the massive lower lip and recedent chin. The Negro's upper lip, his supralabrion, is thrust 7 mm. and his lower lip, his sublabrion, 8 mm. in front of the Englishwoman's lip. It is this marked prognathism, which is the great differentiating factor in the silhouettes.

A good measure of prognathism in the living consists in drawing a line touching the nose and the lower lip, and then marking how much of the chin this line cuts off. In the case of the Englishwoman the subtense of the segment which this tangent cuts from the chin is about 5 mm. In the case of the Englishman the subtense falls to about 3 mm.; while for the Negro this tangent lies 6 or 7 mm.

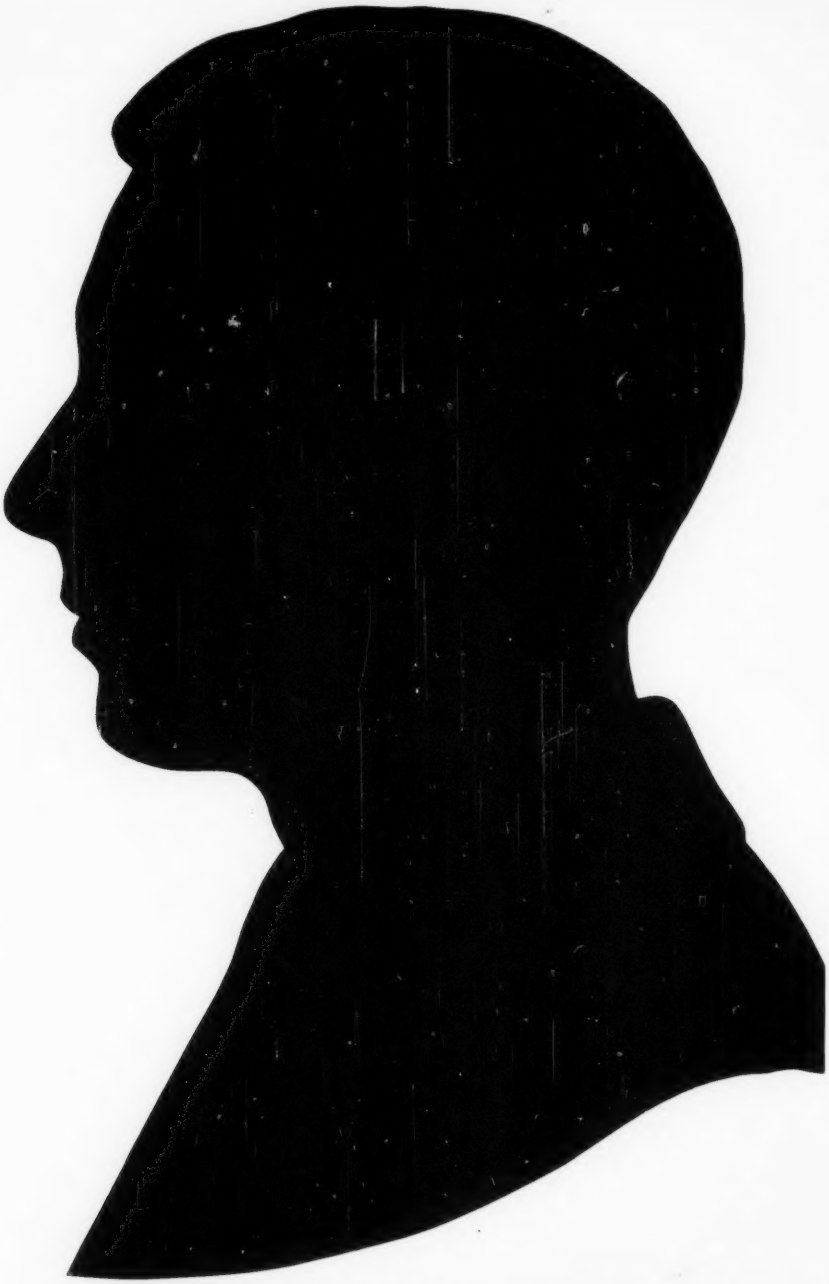
anteriorly to the progenion, and so this line does not cut the chin at all. In the matter of prognathism the Englishman is somewhat nearer to the Negro than the Englishwoman. But from protion round to lophion there is a startling accordance in the headshape between Negro and Englishwoman notwithstanding the physiognomic differentiation in the portraits as a whole*. Till we know more than we do at present of the origin of the modern races of man, we probably gain little by speaking of the Negro races as more "primitive" than the European. But those who believe this word carries some significance, may feel themselves justified in affirming that the Englishwoman is more "primitive" than the Englishman. For us the statement can have little significance until we have at our command a long series of silhouettes of the various living races of man—and this for both sexes. What we have endeavoured to indicate in this paper is that type silhouettes prepared in a standardised manner may be of considerable anthropological value, and might legitimately replace much of the very unsystematic measurement of native races at present undertaken by anthropologists. At the same time we wish it to be understood that this paper is only published as a suggestion for far more detailed work and does not attempt a complete study of even two races.

* It is solely a study of skull-contours and silhouettes which can teach the student how very slight in appearance are those measurable differences upon which man's appreciation of individuality in his own species rests.



Type Silhouette based on 100 West African Negroes photographed by Rudolf Pöch and J. Weninger. Reduction $\frac{1}{2}$ linear.

UNIV. OF MICH.



Type Silhouette based on 50 English ♂ Undergraduate Profiles drawn in the Galton Laboratory with the Silhouetting Apparatus. Reduction $\frac{1}{2}$ linear.

UNIV. OF MICH.

Type Silhouette based on 50 English ♀ Undergraduate Profiles drawn in the Galton Laboratory with the Silhouetting Apparatus. Reduction ½ linear.

MISCELLANEA.

Note on the Association of Relative Laterality of Hand and Eye from the Cambridge Anthropometric Data.

By M. F. HOADLEY.

Two papers have recently appeared in *Biometrika** dealing with the association of Dextrality and Sinistrality in Hand and Eye. In the former memoir Mr T. L. Woo took 5000 cases of males from Galton's data obtained at the Health Exhibition of 1884 and found the correlation between difference of Visual acuity of right and left eyes measured by the distance in inches at which diamond type could be read and the difference in Grip in pounds of right and left hands. The conclusion arrived at was that "there is no relation either linear or skew, between a superiority of the eye and a superiority of the hand."

In the Anthropometric Laboratory of the Cambridge Philosophical Society the same characters were measured for a number of undergraduates and graduates between the years 1884 and 1904. Owing to the kindness of the Society the data obtained were placed at the disposal of the Galton Laboratory for reduction and in the course of this it seemed possible to discuss Mr Woo's conclusions on an independent series of measurements. The material was first sorted to exclude all men who were not between the ages of 18 and 26 and all who were obviously of foreign extraction. This provided nearly 9000 cases but owing to changes in the method of taking the acuity of vision it was necessary to divide the data into three distinct groups.

In the first period, 1884—Jan. 15th, 1891, the distance at which diamond type could be read without glasses was measured in inches. In the second period, Jan. 16th, 1891—July 17th, 1897, the measurements only fell on certain figures between 14 and 100 and from this it was apparent that a logarithmic scale had been used. The logarithms of the numbers which occurred were written down and the differences were taken, from these logarithms the mean difference was found to equal ·071156. By taking the logarithm of 100 equal to 2 and subtracting this difference 12 times the value for log 14 was obtained correct to seven figures and approximately close values for the figures in between. The differences of visual acuity of right and left eyes were then taken as multiples of this factor $x = ·071156$. In the third period, July 18th, 1897—1904, it is not clear what scale was used, the maximum distance at which the diamond type could be read is about twice the distance when the inch scale was used and is therefore not great enough for the measurements to have been in cms. We could not therefore discover the nature of the unit used†.

The following results were obtained:

1884—*January 15th*, 1891.

Ocular Dextralists	Ocular Ambilateralists	Ocular Sinistralists
882 27·27 °/₀	1269 39·24 °/₀	1083 33·49 °/₀

Manual Dextralists	Manual Ambilateralists	Manual Sinistralists
2237 69·17 °/₀	241 7·45 °/₀	756 23·38 °/₀

* Vol. XIX. pp. 165—210, and Vol. XX^{A}. pp. 79—148.

† Unfortunately very little information seems available at this interval of time as to the nature of the measurements.

January 16th, 1891—*July 17th*, 1897.

Ocular Dextralists	Ocular Ambilateralists	Ocular Sinistralists
1423 35·55 °/₀	1804 45·07 °/₀	776 19·38 °/₀

Manual Dextralists	Manual Ambilateralists	Manual Sinistralists
2636 65·85 °/₀	243 6·07 °/₀	1124 28·08 °/₀

July 18th, 1897—1904.

Ocular Dextralists	Ocular Ambilateralists	Ocular Sinistralists
618 42·71 °/₀	474 32·76 °/₀	355 24·53 °/₀

Manual Dextralists	Manual Ambilateralists	Manual Sinistralists
996 68·83 °/₀	80 5·53 °/₀	371 25·64 °/₀

The three tables for manual laterality agree quite closely with Mr Woo's table, which showed that the dextralists are in the majority but cannot be considered as three-quarters of the population, and that while there are very few ambilateralists they cannot however be ignored.

On the other hand the tables for ocular laterality in no way agree either with Mr Woo's or with each other.

It seems probable that the change in visual acuity methods of measurement largely influences the results, partly by diminishing the class of ambilateralists, and increasing in different proportions the ocular dextralists and sinistralists. This would clearly arise, if the frequency curve for ocular laterality were a normal distribution, the mean of which did not coincide with ambilaterality; then any alteration in the unit of visual acuity, as a reduction in its size, would reduce ambilaterality but not increase equally the dextral and sinistral groups.

Mr Woo's table gave for 4948 cases:

Ocular Dextralists	Ocular Ambilateralists	Ocular Sinistralists
1108 22·82 °/₀	2711 54·79 °/₀	1129 22·39 °/₀

From this he naturally concluded that of the general community more than half are ocular ambilateralists and that the difference between the percentages of ocular dextralists and sinistralists is insignificant*.

As regards the Cambridge data the greatest percentage of ocular ambilateralists is 45 and in the third group the percentage is even as small as 32; whereas, in one case the ocular sinistralists exceed the dextralists by over 6 °/₀, in the other two the dextralists exceed the sinistralists by 16 °/₀ and 18 °/₀ respectively.

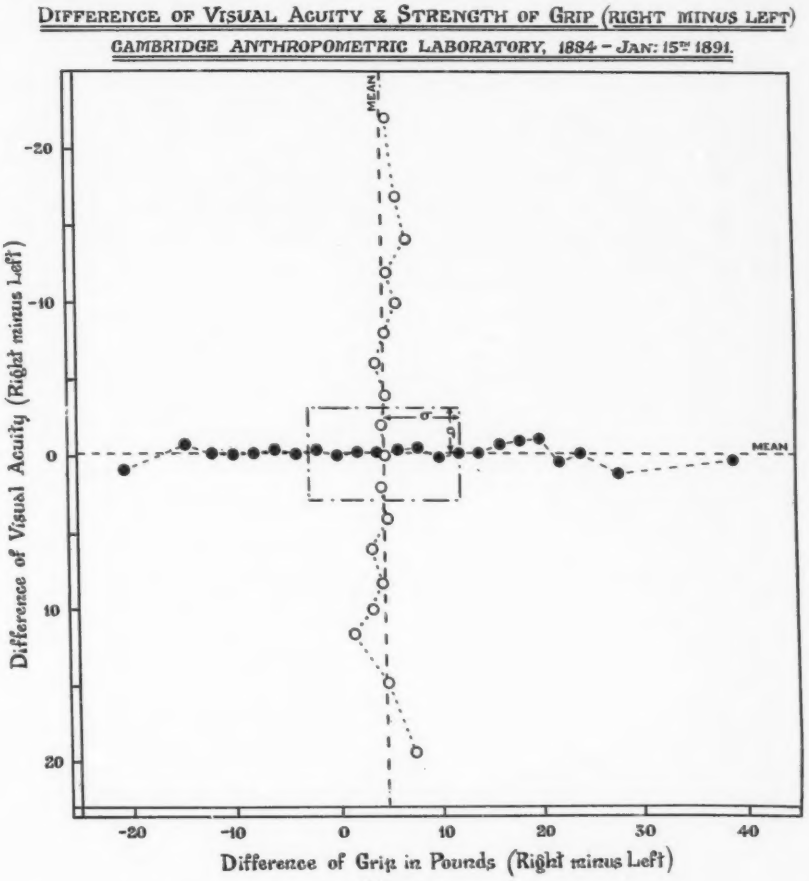


Diagram I.

It is obvious that from these diverse percentage results, obtained by rather crude methods of measuring visual acuity, no definite conclusions as to percentages can be drawn.

* This latter conclusion is practically maintained in Mr Woo's paper in *Biometrika*, Vol. xx[A]. (see p. 87), but by a finer measurement of visual acuity the dextralist and sinistralist groups have been about equally increased.

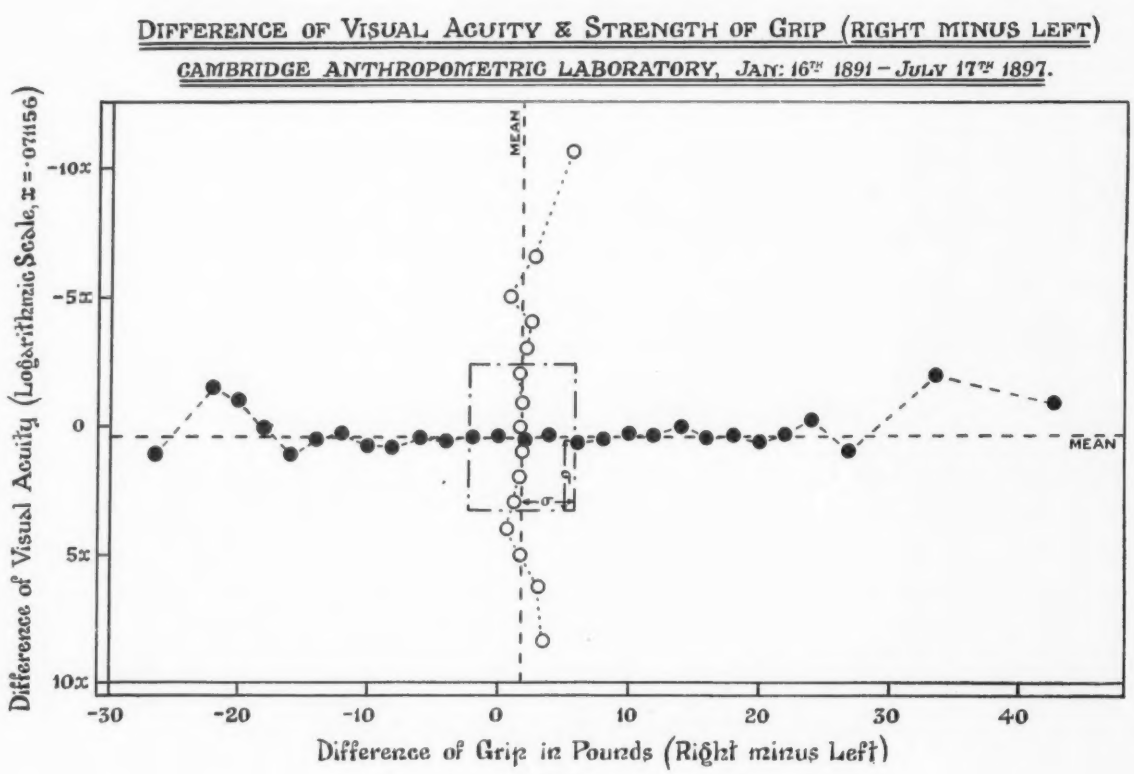

DIFFERENCE OF VISUAL ACUITY & STRENGTH OF GRIP (RIGHT MINUS LEFT)
CAMBRIDGE ANTHROPOMETRIC LABORATORY, JAN: 16TH 1891 – JULY 17TH 1897.
Difference of Visual Acuity (Logarithmic Scale, x = ·071156)
-10x
-5x
0
5x
10x
MEAN
MEAN
σ
σ
-30
-20
-10
0
10
20
30
40
Difference of Grip in Pounds (Right minus Left)

Diagram II.

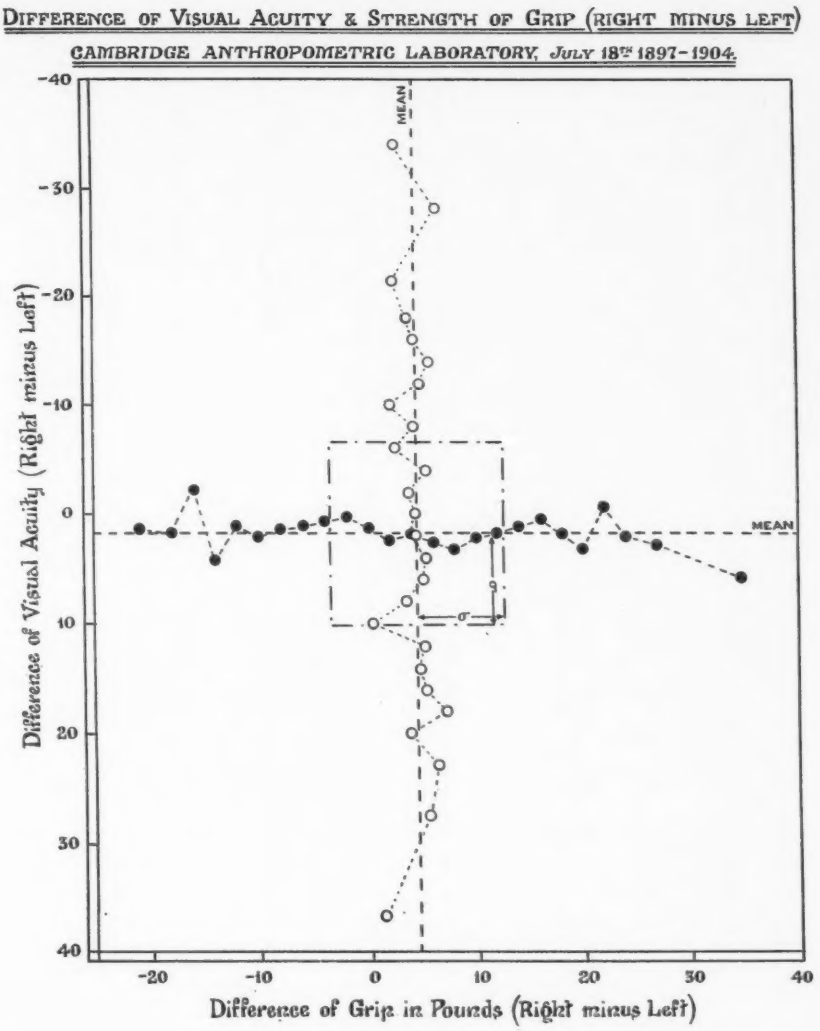


Diagram III.

To obtain a more accurate measure of the relationship of ocular and manual laterality we turn to the correlation tables (see pp. 406 and 407), on which the diagrams above were based. These indicate no association.

TABLE I. *Cambridge Anthropometric Data*, 1884—*January* 15*th*, 1891.

Difference of Strength of Grip in Pounds (Right minus Left).

Difference of Visual Acuity in Inches (Right minus Left).

	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	-4	-2	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	Totals
−24	.	.	.	.	.	.	.	.	.	.	.	1	.	·5	2·5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
−22	.	.	.	.	.	.	.	.	.	.	.	.	·5	2·5	.	.	.	.	.	.	.	.	·5	·5	.	.	.	.	.	.	.	.	.	.	.	.	.	4
−20	.	.	.	.	.	.	.	.	.	.	.	.	·5	·5	.	.	.	.	.	·5	1	1	·5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
−18	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.	·5	2·5	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6
−16	.	.	.	.	.	.	.	.	.	.	1	.	·5	·5	1	1	.	·5	1·5	1	.	.	·5	·5	.	.	.	.	.	.	.	.	.	.	.	.	.	8
−14	.	.	.	.	.	.	.	.	.	.	.	.	·5	2·5	1	.	·5	2·5	2	1	·5	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	13
−12	.	.	.	.	.	.	·5	·5	.	.	.	1	1·5	2·5	1·5	1	1·5	2	2·5	3	1	·5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	19
−10	.	.	.	.	.	.	.	.	.	1	.	·5	2·5	2	1	2	6·5	5·5	1	.	2	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	26
−8	.	.	.	.	.	.	.	·5	·5	.	.	3	5	7	9	9·5	7·5	6	3·5	2·5	3·5	2·5	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	61
−6	.	.	.	.	.	1	1	2	2·5	4·5	.	6·5	6	14	7	13·25	13·75	10	5·5	5·5	2·5	5	·5	·5	·5	.	.	.	.	.	·5	·5	.	.	.	.	102·5
−4	.	.	.	.	1	.	1	9	5	14	14·75	16·75	28·5	27·25	27·75	23·5	21·5	23·5	14	14·5	9·5	4	3·5	1	2	1	1	·5	.	1	.	1	.	.	·5	·5	267·5
−2	·5	·5	1·5	1·5	1	1·5	3·5	7·5	10·5	13·5	20	24·25	38·25	52	53·25	61·5	65·75	64	51·25	35·25	28	13	13·5	5	2	5	1	.	.	.	.	.	.	.	.	.	574·5
0	·5	·5	·5	2·5	·5	2	3	7·5	16·5	18	41	68·5	104·75	138·25	118·5	143	145	119·5	109·25	76·75	59·5	40	22·5	13·5	9	5	2	1·5	1	1·5	·5	.	1	.	.	.	·5	1272
2	.	.	.	.	1	1·5	1	4·5	9·5	10	15·5	20·5	34·25	53·25	50·75	45·25	50	35	44	23·5	18	11·5	7·5	5·5	3·5	2	1·5	1	1·5	·5	.	.	.	.	.	.	.	452
4	.	.	.	.	.	·5	1·5	1·5	3	1	7·5	12	13·5	23	19·25	20·25	20·5	17·5	12·5	19	10	3·5	3·5	·5	·5	3	·5	·5	2	.	.	.	.	.	.	.	.	196·5
6	.	.	.	·5	·5	.	.	2	3	1·5	3·75	5·25	3·5	10·5	13	9	11·5	6	5	5·5	4·5	3	1·5	·5	.	.	.	.	.	.	.	.	.	.	.	.	.	90
8	.	.	.	.	.	.	.	2	2	.	1·25	1·75	4	8	6·5	4·5	4	2	4	2·5	4·5	1·5	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	47·5
10	.	.	.	.	.	.	.	·5	1·5	2	.	1	1·5	3·5	2·5	4·5	2·5	4·5	5·5	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	31·5
12	.	.	.	.	1	.	.	.	.	.	·5	3	1	2·5	3·5	2·5	1·25	2	1·5	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	19·5
14	.	.	.	.	.	.	.	.	.	.	.	.	·5	2·5	·5	1·75	·25	.	·5	·5	2·5	·5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	9·5
16	.	.	.	.	.	.	.	.	.	.	.	1	·5	3	.	.	.	·5	1·5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6·5
18	.	.	.	.	.	.	.	.	.	.	·5	.	.	.	.	1	1	1·5	2·5	.	.	.	.	·5	·5	.	.	.	.	.	.	.	.	.	.	.	.	.	7·5
20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	2
22	.	.	.	.	.	.	.	.	.	.	.	.	·5	3	·5	·5	·5	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6
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34	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Totals	1	1	2	4·5	4	6·5	10·5	26·5	58·5	53·5	109	164·5	237·5	361	320·5	349	358	303·5	277	194	153·5	92	56·5	32·5	17	17	7	3·5	4·5	·5	3	.	1·5	·5	·5	1·5	1	3234

TABLE II. *Cambridge Anthropometric Data*, *January* 16*th*, 1891—*July* 17*th*, 1897.

Difference of Strength of Grip (Right minus Left).

Difference of Visual Acuity (Right minus Left).

	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	-4	-2	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	Totals
−14x	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
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− 9x	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	·5	·5	.	.	.	.	.	.	.	.	.	.	.	.	.	2
− 8x	.	.	.	.	.	.	.	.	.	.	.	.	.	·5	·5	.	.	.	1·5	1	·5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
− 7x	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
− 6x	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	2	1	1	.	.	1	1	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	8
− 5x	.	.	.	.	.	1	1	.	.	.	.	.	.	·5	1·5	4	5·5	1·5	1	.	3·5	1·5	1	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25
− 4x	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3·5	2·5	1	3	2·5	3·5	1	2·5	2	2	1·5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25
− 3x	.	.	.	.	.	.	.	1	.	.	.	·5	·5	2·5	3·5	5	8·5	4·5	4	3·5	5	2	1·5	·5	2	2	1·5	·5	·5	.	.	.	.	.	.	.	.	.	.	.	.	50
− 2x	.	.	.	.	.	1	1	.	1	3	3·5	3	4·5	9	7·5	10·5	16	20	12·5	18·5	7·5	6·5	8·5	3·5	·5	.	8·5	2	1	1	1	.	·5	1·5	.	·5	·5	.	.	.	137
− x	1	.	.	.	.	.	·5	3	2·5	4	6	10·5	15	27·5	29·5	51	53	49	50·5	46·5	39	52·5	36	21·5	13	8·5	2	1	1	1	.	·5	·5	·5	1	.	.	.	.	.	520
0	.	.	.	·5	2·5	2	5·5	10	9	14·5	25	37·5	56·5	88·5	105	118·5	187	195	202	190·5	136	135·5	88	63	45	43·5	24	10	8	3·5	2·5	·5	.	1	.	.	.	1·5	1	·5	1804
x	.	.	.	.	·5	1·5	2	3·5	4·5	5	6·5	15	22	45·5	63	71	101	100	97	107	98·5	72	47	31	20·5	21·5	10	9	1·5	5	1	1	.	.	.	.	.	.	.	.	.	963
2x	.	·5	1	·5	.	.	.	2·5	4	3	3	6	11·5	12	16·5	20·5	31	25·5	32	35·5	29	21	19	8	6	2	3·5	2·5	2·5	·5	1	.	.	.	.	.	.	.	.	.	300
3x	.	.	.	.	.	.	.	.	.	.	·5	3·5	2·5	4·5	7·5	8·5	8·5	10·5	10	6·5	10	2·5	4	3	2·5	·5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	85
4x	.	.	.	.	.	.	.	.	·5	·5	1	1	1·5	1	2·5	3·5	4	1·5	2	3	3·5	2	1	1	·5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	30
5x	.	.	.	.	.	.	.	.	.	.	1	.	.	·5	1	2	2·5	3	2	4	·5	.	1·5	1·5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	18
6x	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	2	2·5	1·5	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	·5	1·5	.	.	.	.	.	.	10
7x	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6
8x	.	.	.	.	.	.	.	.	.	.	.	.	1	·5	·5	·5	1	1	.	.	.	1·5	·5	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	8
9x	.	.	.	.	.	.	.	.	.	.	.	.	.	.	·5	.	.	.	.	.	.	.	.	·5	·5	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1
10x	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	·5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Totals	1	·5	1	1	3	4·5	10	21	20·5	28	45	78·5	113·5	190	245	286·5	417	416	429	414	345	301·5	210	146	95·5	69·5	43	24·5	14·5	10·5	4·5	1·5	2·5	3·5	.	·5	1·5	1·5	1·5	1	4003

$x = 0711560.$

10x	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Totals	1	·5	1	1	3	4·5	10	21	20·5	28	45	78·5	113·5	190	245	286·5	417	416	429	414	345	301·5	210	146	95·5	69·5	43	24·5	14·5	10·5	4·5	1·5	2·5	3·5	.	·5	1·5	1·5	1·5	1	4003

$x = \cdot 0711599.$

TABLE III.

Cambridge Anthropometric Data, July 18*th*, 1897—1904.

Difference of Strength of Grip (Right minus Left).

Difference of Visual Acuity (Right minus Left).

	−24	−22	−20	−18	−16	−14	−12	−10	−8	−6	−4	−2	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	..	52	Totals
−36	.	.	.	.	.	.	.	.	.	.	·25	·25	.	.	.	·5	·5	.	·25	·25	.	.	.	.	.	.	.	.	.	..	.	2
−34	.	.	.	.	.	.	.	.	.	·25	1	·75	.	.	.	.	.	.	·25	·25	.	.	.	.	.	.	.	.	.	..	.	2·5
−32	.	.	.	.	.	.	.	.	.	·25	·25	.	.	.	1	.	.	·25	·25	.	.	.	.	.	.	.	.	.	.	..	.	2
−30	.	.	.	.	.	.	.	.	.	.	.	·5	.	.	.	.	·5	·25	·25	.	.	.	.	.	.	.	.	.	.	..	.	2
−28	.	.	.	.	.	.	.	.	.	.	.	·5	.	.	.	.	.	.	.	·25	·25	.	.	.	.	.	.	.	.	.	..	.	1
−26	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	·25	·25	.	.	.	.	.	.	.	.	.	..	.	1·5
−24	.	.	.	.	.	.	.	.	.	.	·5	·5	1	.	.	.	.	.	.	.	.	.	.	·5	·5	.	.	.	.	.	..	.	3
−22	.	.	.	.	.	.	.	.	.	.	.	1·5	·5	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	..	.	3
−20	.	.	.	.	.	.	.	.	.	·25	1·75	·5	·5	1	·75	·25	.	·5	.	.	.	.	.	.	.	.	.	.	.	..	.	5·5
−18	.	.	.	.	.	.	.	.	.	·25	1·25	·25	1·25	1	·75	1·25	2	·5	.	.	.	·25	·25	.	.	.	.	.	.	..	.	9
−16	.	.	.	.	.	.	.	.	1	.	·5	·25	2	1	·75	1·25	·25	1·25	·75	.	·25	·5	·25	.	.	.	.	.	.	..	.	10
−14	.	.	.	.	.	.	.	.	1	1·25	·5	·5	2·75	2·75	·75	1·5	·5	·5	1	1·5	·75	·25	·5	.	.	·5	·5	.	.	..	.	17
−12	.	.	.	.	.	.	.	·5	·75	·25	·25	1·5	3·25	2·5	1·5	1·75	3·5	1	1	·5	1·5	·25	·5	.	.	.	.	.	.	..	.	20·5
−10	.	.	.	.	.	.	.	·5	2·75	·25	·5	3·25	1·5	1·75	3	2·25	1	·25	·75	·75	·5	.	·5	.	.	.	.	·5	·5	..	.	19·5
−8	.	·5	·5	.	.	.	.	1·25	·25	.	1·75	2·5	4	3	3·75	3·25	·75	·25	1	2·75	1·5	·5	·5	.	.	.	.	·5	·5	..	.	29
−6	.	.	.	.	·5	.	·5	1·75	3	3·5	3·5	3·75	6·25	6	9·25	4·5	3·75	3·5	3·75	1	1	.	·25	·75	·5	.	.	.	.	..	.	57
−4	·25	·25	.	·25	·75	1	2·25	·75	·5	2·5	2·25	4	4·25	4·75	4·75	4·5	4	3·75	5·75	2	4	2·75	1·5	1·25	.	.	.	·5	·5	..	.	59
−2	·25	·25	.	·75	·75	·5	2	2·25	4·25	1·5	4·5	5·75	9·25	9	6·5	6·5	5·5	9·25	5	5·75	2·5	1·75	1	1·75	·25	·25	.	.	.	..	.	87
0	.	.	2	2	1·5	2·5	4·75	7	8·75	18·75	40	43·5	52·25	62	51·5	42	34·25	45·5	30	27·75	20·75	12·25	7·25	2·5	3	2·75	1·5	.	.	..	.	526·5
2	.	.	1	.	1	.	1·25	3·5	3	3	5·25	9·5	9·75	7·5	8·75	6·5	9	10·25	5·5	4·75	6	3·5	·25	·5	·75	·75	·25	.	.	..	.	101·5
4	.	.	.	.	.	.	1·75	3·5	2·5	4·5	5·75	4·25	5·25	7·25	9·75	8·25	10·5	11·25	9·5	6·25	4	·75	1	1	.	·25	·25	·5	·5	..	.	98·5
6	.	·25	·5	·75	.	.	·5	1·75	1·25	2·5	3·5	4·25	10·5	8	9·5	9·25	11·75	7·5	7·5	4·75	3·25	1	1·5	·25	.	·25	·25	.	.	..	.	90·5
8	.	·5	·75	·75	.	1·25	·25	·25	1·5	2	5·25	7·25	9·5	9·25	7·5	4·25	7	5·75	4·25	2	2·25	1·25	2·25	·25	·25	·25	·25	.	.	..	.	76
10	.	·25	·25	.	.	·75	·25	·5	1·5	2	4	2·75	4	8	5·75	8·5	7·5	5·25	1	2·5	·5	1·25	·5	·75	·75	.	.	.	.	..	.	58·5
12	.	.	.	.	.	·5	.	.	1	1·25	2·5	1·75	2	7	4·75	3·5	3	3·25	1·25	1	·25	·5	1	·5	1	·5	.	.	.	..	.	36·5
14	.	.	.	.	.	.	.	·5	·5	2	2	1·25	2·5	5	5·5	2·75	3·5	3	3·25	2	·25	·5	·5	.	.	.	.	.	.	..	.	35
16	.	.	.	.	.	1	1	·5	·5	·5	1·25	1·75	2	4·75	4	3	3	1·25	·75	1·5	1·25	1·5	1·5	·5	·5	.	.	.	.	..	.	32
18	.	.	.	.	.	.	.	·25	·75	.	·5	·5	1·75	1·75	1·75	3	1·5	2·75	·5	.	.	.	.	.	.	.	.	.	.	..	1	16
20	.	.	.	.	.	.	.	·5	·5	.	.	·25	1·75	2·75	2	1·75	3	1	·5	.	.	.	.	.	.	.	.	.	.	..	.	14
22	.	.	.	.	.	.	.	·25	·25	.	.	·25	1·75	1	·5	·75	·75	·5	·5	·25	·25	.	.	.	.	.	.	·5	·5	..	.	8
24	.	.	.	.	.	.	.	.	.	1	.	·5	1	1	·5	.	.	.	1	·75	·5	·25	.	.	.	.	.	.	.	..	.	6·5
26	.	.	.	.	.	.	.	.	.	.	·75	·75	.	.	·5	·25	·25	1·25	1·25	·5	·25	·25	.	.	.	.	.	.	.	..	.	6
28	.	.	.	.	.	.	.	.	.	.	·75	·25	.	.	.	·25	·25	·25	·25	.	.	.	.	.	.	.	.	.	.	..	.	2
30	.	.	.	.	.	.	.	.	.	.	·25	·25	·75	·25	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	..	.	3·5
32	.	.	.	.	.	.	.	.	.	.	·25	·25	·75	·25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	..	.	1·5
34	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	..	.	.
36	.	.	.	.	.	.	.	.	.	.	.	.	.	.	·25	·25	.	.	.	.	.	.	.	.	.	.	.	.	.	..	.	·5
38	.	.	.	.	.	.	.	·5	·5	.	.	.	.	.	·25	·5	·25	.	.	.	.	.	.	.	.	.	.	.	.	.	..	.	2
40	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	·75	·75	.	.	.	.	.	.	.	.	.	.	.	.	..	.	1·5
Totals	·5	2	4	5·5	3·5	8·5	14·5	26	34·5	48·5	91·5	105·5	142	158·5	146·5	124·5	119·5	121	87	69·5	52·5	29	19·5	11·5	7·5	5·5	3	2·5	2	..	1	1447

Actually the correlations between difference of visual acuity and difference of strength of grip as found for the three series were as follows:

1884—*January* 15*th*, 1891.

$r = -\cdot 024{,}10 \pm \cdot 012{,}04,$

$\bar{\eta}^2_{RE.RH} = \cdot 010{,}82 \pm \cdot 001{,}73, \quad \eta^2_{RE.RH} = \cdot 012{,}93,$

$\bar{\eta}^2_{RH}{}^{.RE} = \cdot 007{,}73 \pm \cdot 001{,}46, \quad \eta^2_{RH.RE} = \cdot 010{,}57.$

January 16*th*, 1891—*July* 17*th*, 1897.

$r = -\cdot 007{,}38 \pm \cdot 010{,}66,$

$\bar{\eta}^2_{RE.RH} = \cdot 009{,}49 \pm \cdot 001{,}71, \quad \eta^2_{RE.RH} = \cdot 013{,}13,$

$\bar{\eta}^2_{RH.RE} = \cdot 005{,}00 \pm \cdot 001{,}07, \quad \eta^2_{RH.RE} = \cdot 009{,}74.$

July 18*th*, 1897—1904.

$r = +\cdot 029{,}62 \pm \cdot 017{,}72,$

$\bar{\eta}^2_{RE.RH} = \cdot 020{,}04 \pm \cdot 012{,}82, \quad \eta^2_{RE.RH} = \cdot 006{,}93,$

$\bar{\eta}^2_{RH.RE} = \cdot 025{,}57 \pm \cdot 012{,}51, \quad \eta^2_{RH.RE} = \cdot 002{,}13.$

As Mr Woo found, so here, there is obviously no significant correlation in any of the three cases. The three diagrams illustrate the complete independence of the superiority of hand and eye as measured on these two characters. It is clear from the frequency distributions that for this ocular and for this manual character, laterality whether of hand or eye is a continuous variety with its modal value at or not far removed from ambilaterality.

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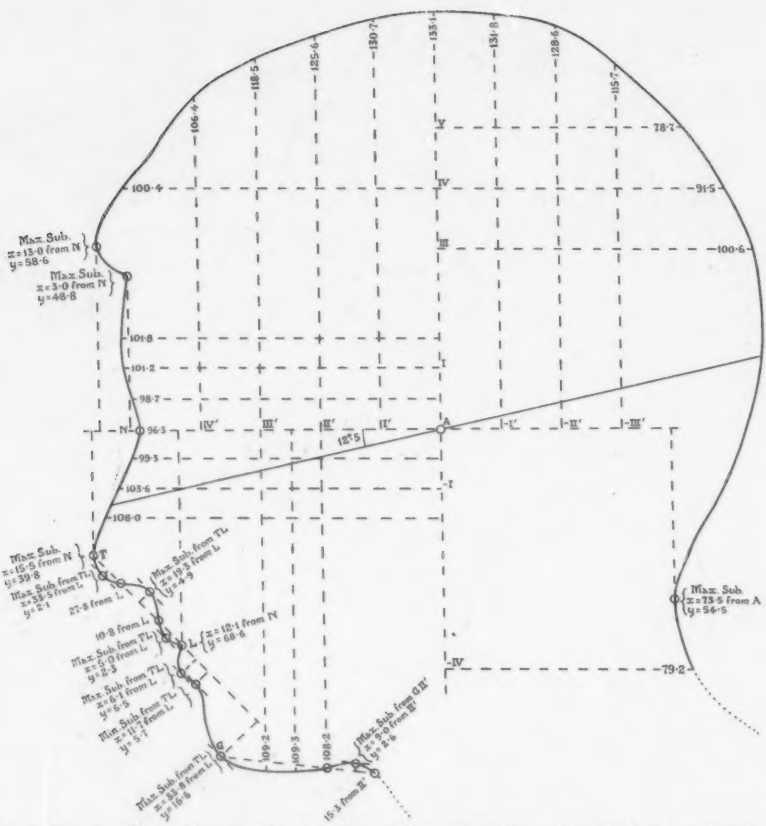

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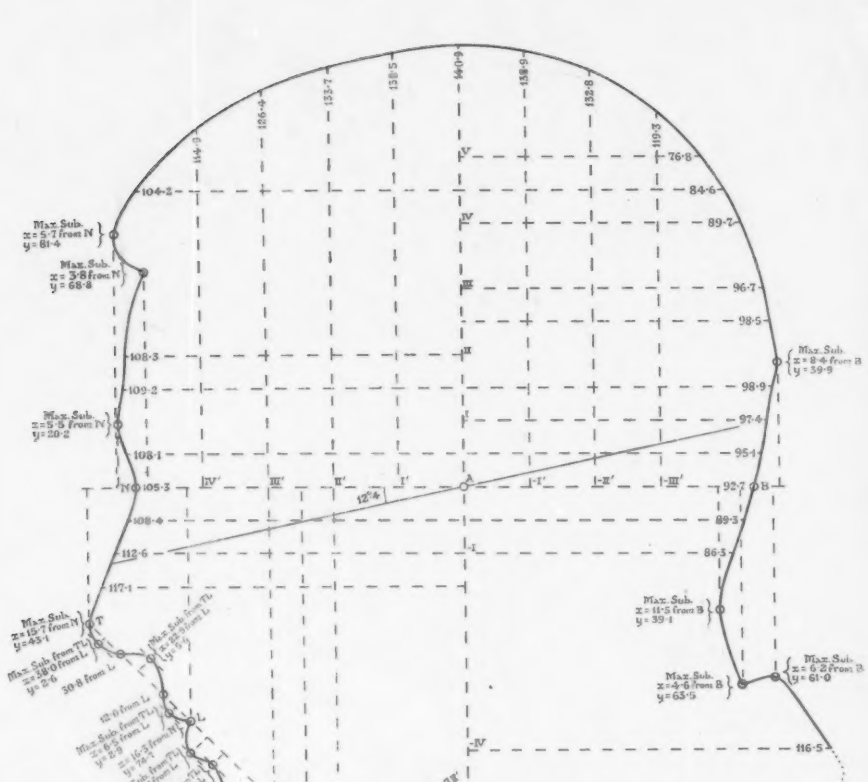

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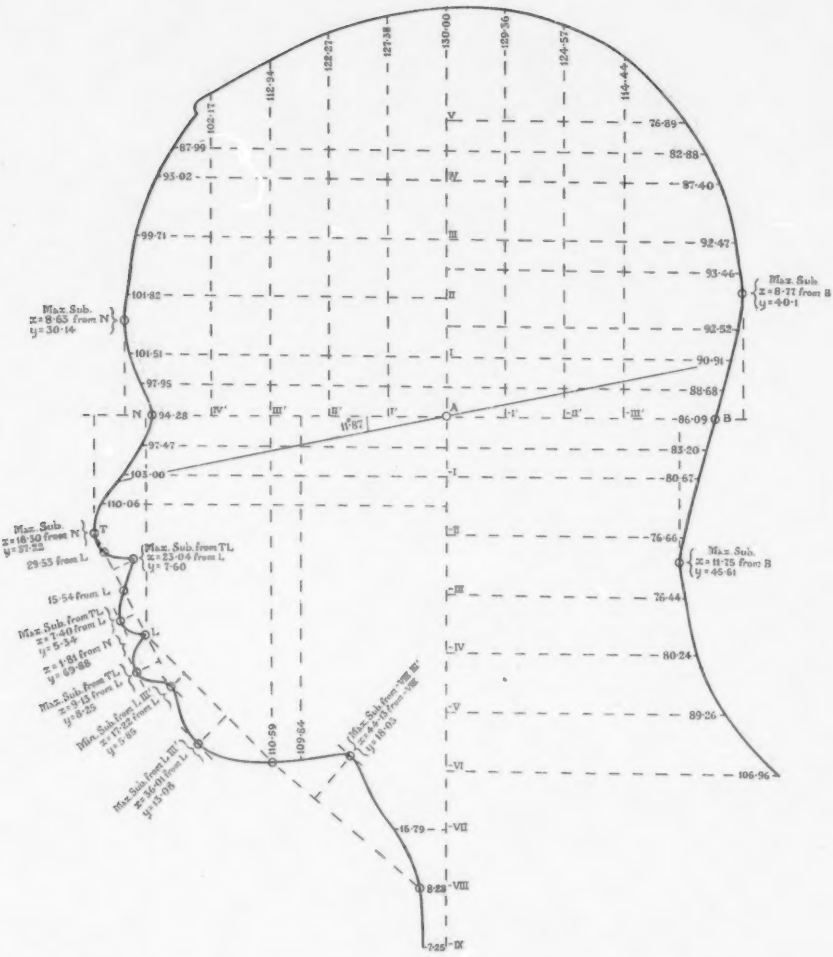

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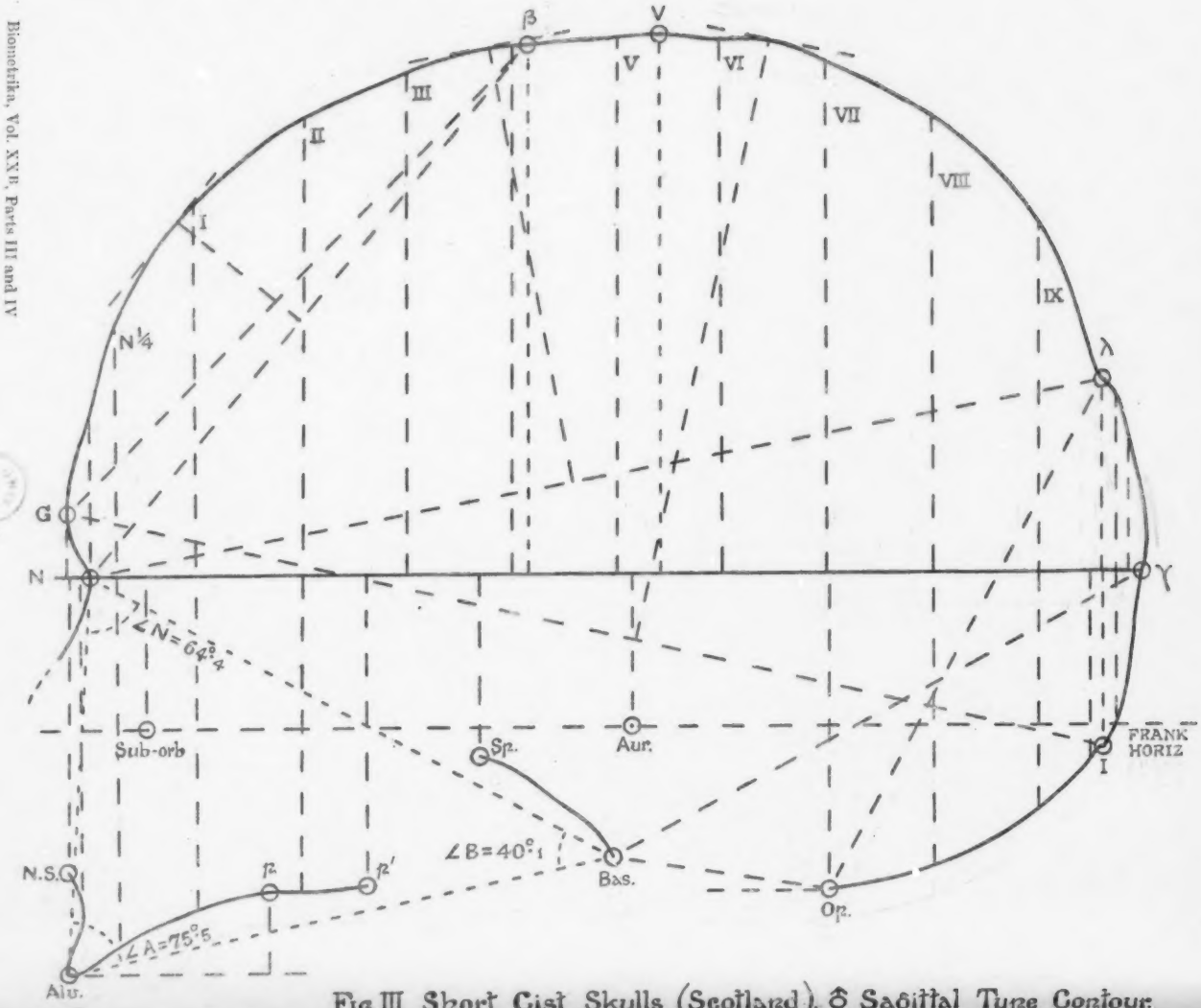

Fig. III Short Cist Skulls (Scotland). ♂ Sagittal Type Contour

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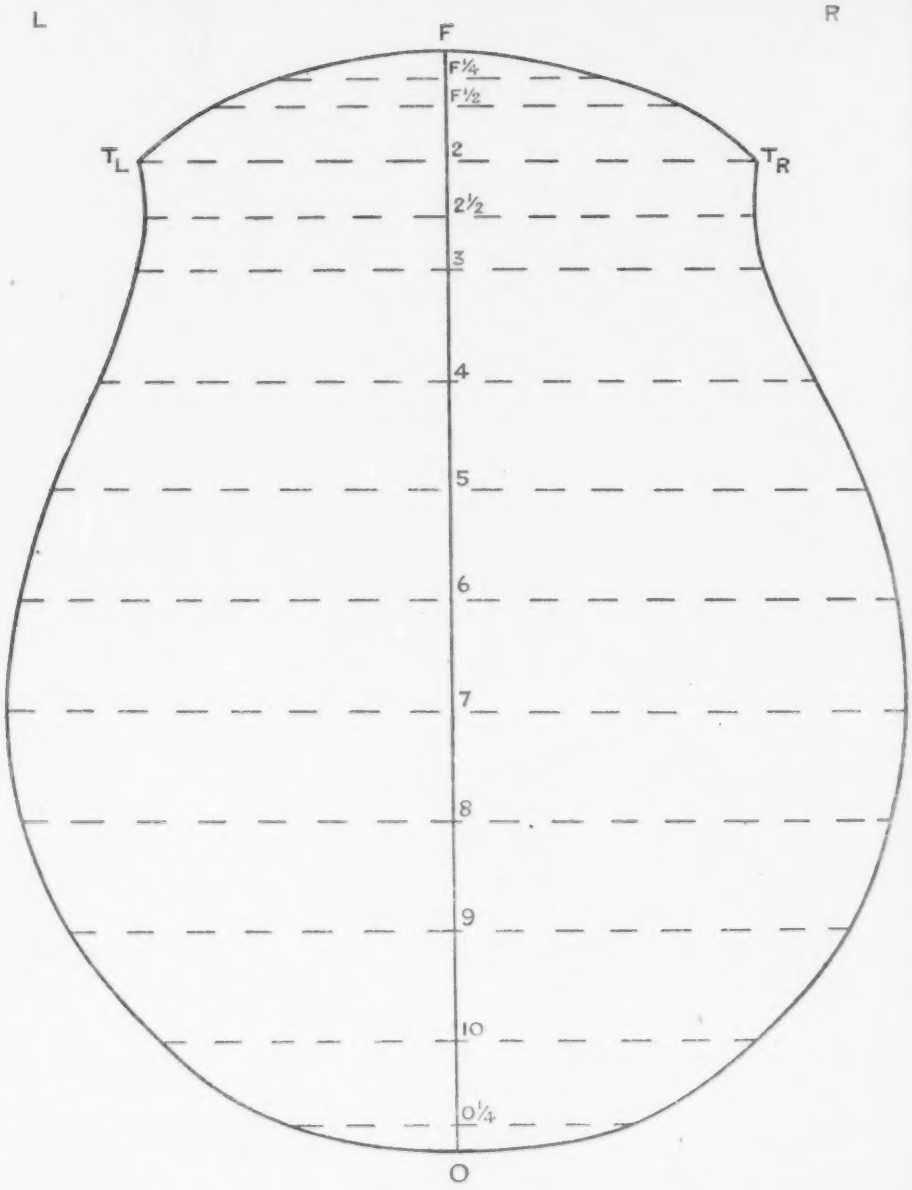
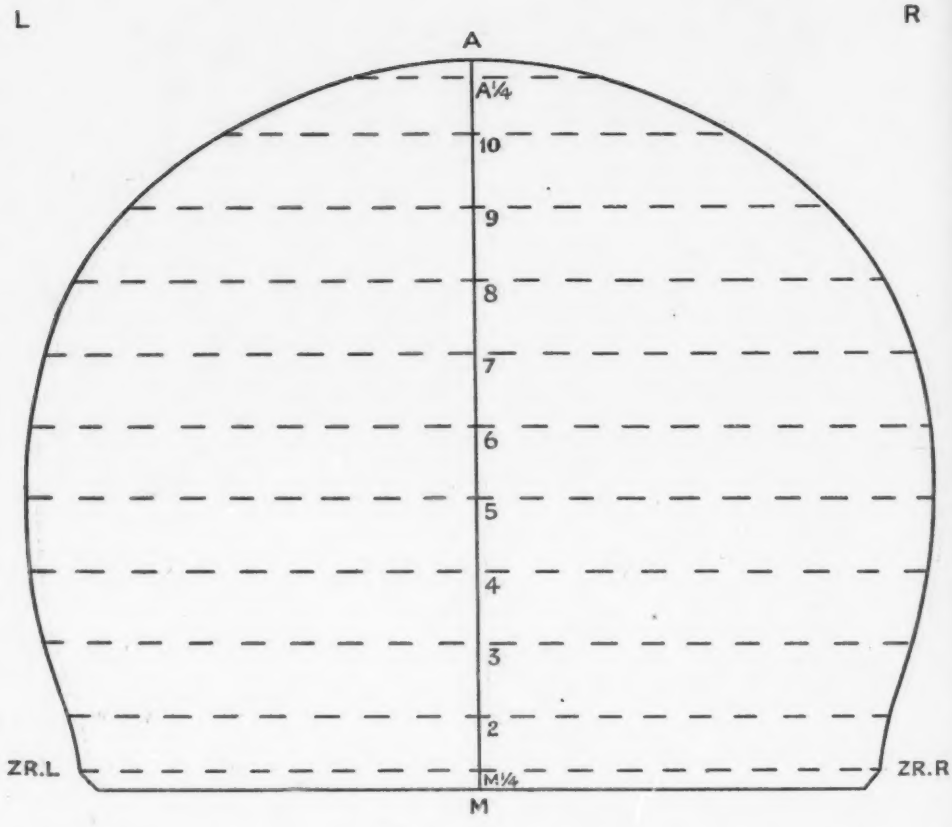


FIG. II Short Cist Skulls (Scotland). ♂ Horizontal Type Contour.



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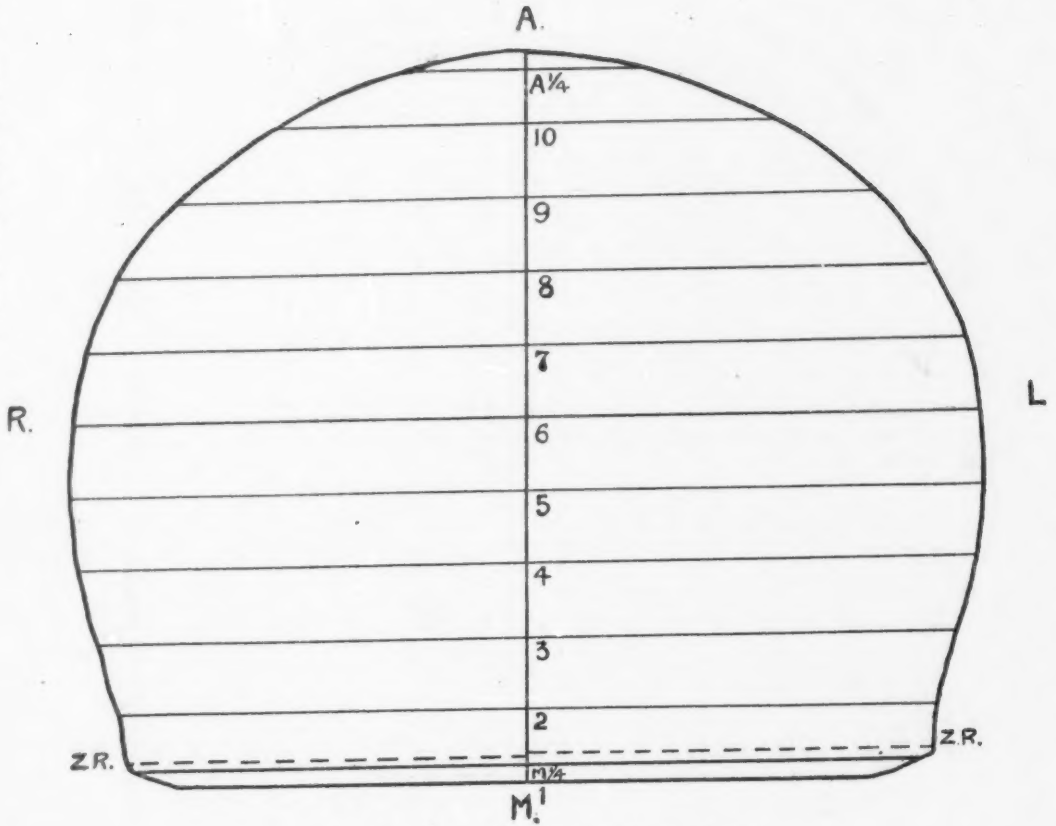
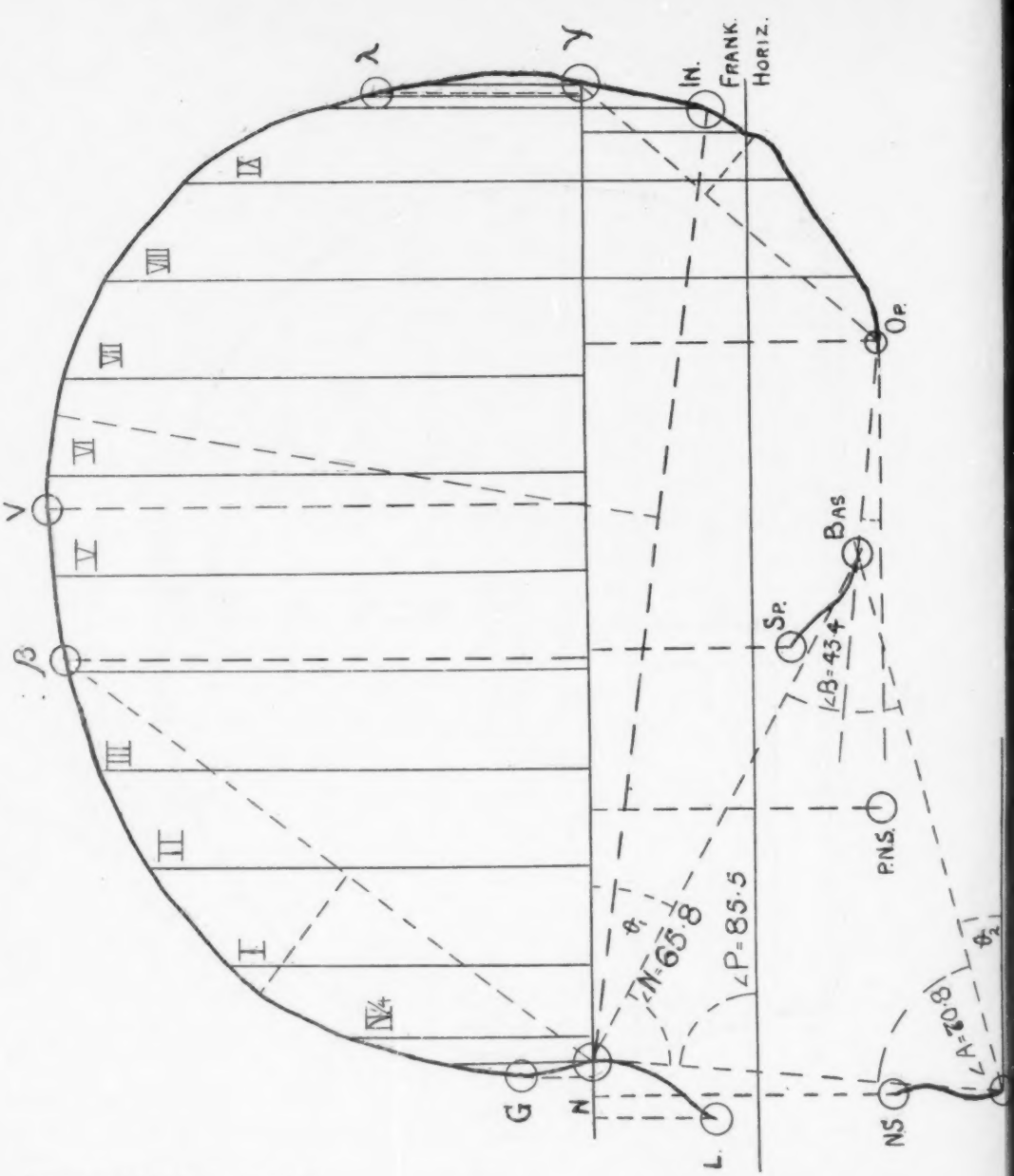


Fig. 2. Hylam Male Vertical Type Contour. (39 Crania.)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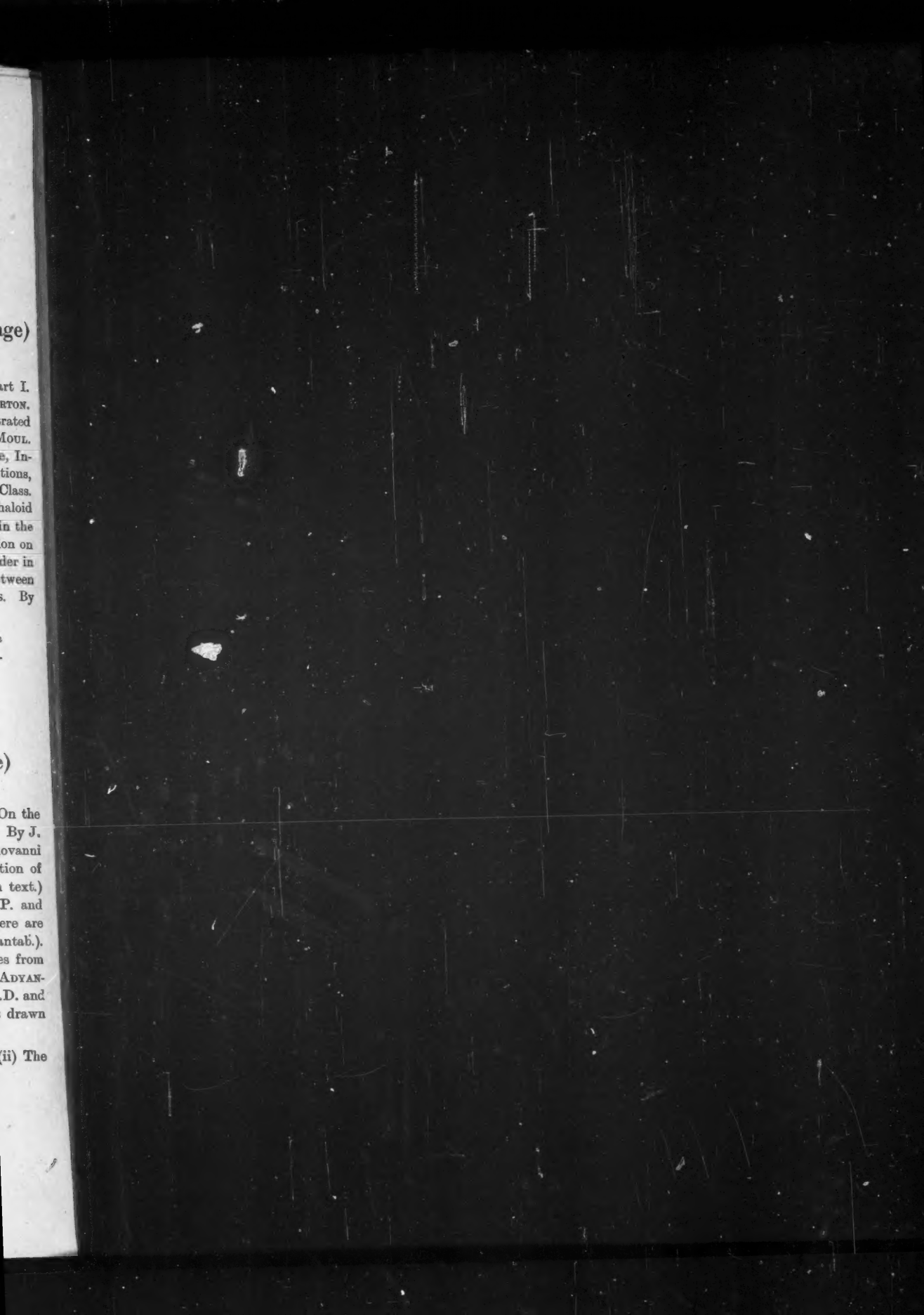
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